BROOKLYN BOTANIC GARDEN

PLANTS & GARDENS

BROOKLYN BOTANIC GARDEN RECORD

PLANTS & GARDENS

HANDBOOK ON GESNERIADS
(AFRICAN-VIOLETS, GLOXINIAS AND THEIR RELATIVES)

Picture Dictionary

Cultural Notes
for All Types
of Gesneriads

Special Articles:

African-Violets
Gloxinias
Episcias
Columneas
Achimenes
Streptocarpus
Miniatures

Breeding
Propagation
Disease Control

How to Display at
Flower Shows

SPRING
1967

NEW SERIES
VOL. 23 No. 1

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CONTENTS

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Copies of this and other issues of PLANTS & GARDENS are available as Handbooks. For a list of topics see back cover.

Hull

STREPTOCARPUS REXII grows at the top of this plant stand. African-violets occupy the middle tier. Lowermost is *Streptocarpus saxorum,* which receives the most hours of sunlight each day from the lower part of a window wall in the living room of Mr. and Mrs. William Henry Hull in Woodbridge, Connecticut.

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Spring 1967

THIS Handbook on African-violets and their kin (Gesneriads) is likely to surprise at least some of our readers because it differs from other Handbooks in our **PLANTS & GARDENS** series. Over the years we have presented authoritative information on many kinds of plants—and the "hows and whys" of gardening and horticultural practices. From time to time articles have included a smattering of botanical terminology, but in this Handbook readers will find more botanical technical descriptions than usual; they seem essential to proper treatment of this little-known family—the *Gesneriaceae.*

What is the family, and why is it unknown to many gardeners? It is a group of mostly tropical plants of more than 100 different genera and perhaps as many as 2,000 different species. Many of these make interesting and attractive house plants in colder climates. To grow such plants rewardingly, let Henry Teuscher be your guide (page 4). And to grasp the diversity of the family, turn to Guest Editor Batcheller's illustrated Dictionary of Gesneriads (page 20). We are particularly indebted to Alfred Byrd Graf for photographs of some of the rarer and more unusual species.

Because the plants originate in tropical climates, plant explorers and interested travelers must first discover them in the wild, and bring them back alive for introduction into cultivation; read Thomas Talpey's fine account of plant hunting which begins on page 41. This and the many other splendid articles by specialists in Gesneriads will give an idea of the time and effort involved in introducing new plants to what is for them a strange new part of the world.

The best known group (genus) in the Gesneria Family *(Gesneriaceae)* is the African-violet, which is not a violet at all. To indicate that the plant is really not what it is called, readers will notice that our Editor has consistently hyphenated the two-word name.

African-violets are the only group in the Gesneria Family that carry a widely accepted common name. Given their rightful title, they are "saintpaulias," after the man who first discovered them about 75 years ago. Mrs. Wright's article (page 9) tells this story. The other groups (genera) of Gesneriads are known only by their botanical names. Most of them are simple enough to know and pronounce, so there is no real need to think up popular names—which are not always popular anyway. Having said this, there is immediately an exception: what we all know as gloxinias should properly be called sinningias. Yet "*Gloxinia*" is the actual botanical genus name for another group of Gesneriads totally unknown to most of us. To get over the hurdle, sinningias are called "florist gloxinias." Dr. Clayberg explains this on page 50. Such misnomers are by no means uncommon in the horticultural world. For example, most of the plants we call "geraniums" actually belong to the genus *Pelargonium.* The Geranium Family *(Geraniaceae)* consists mostly of annual or perennial herbs, and many of those which are true geraniums are simply weeds.

One of the truly technical contributions in the Handbook is by Dr. Robert E. Lee—Chromosome Numbers in the Gesneriaceae (page 79, also see page 72). This is the first time such a compilation has been published. It is basic information chiefly for hybridizers and other specialists, rather than the general reader. Many of the chromosome numbers reported are the result of original researches by Dr. Lee and his associates.

For all who are growing Gesneriads for exhibition, the article by William and Olive Hull provides excellent guidance (page 62).

It is a privilege to acknowledge the devoted service of Guest Editor Frances Bacheller. Our grateful thanks also go to each of the authors she invited to help make this Handbook possible.

George S. Avery

Director

CULTURAL NOTES FOR ACHIEVING SUPREME BEAUTY IN PLANTS

Whether gesneriads are grown for pleasure or profit, idealized controlled conditions give best results

Henry Teuscher

THE ambition of every plant lover or grower will surely be to develop his plants to the fullest beauty of which they are capable. How can this be achieved? The answer is: only with a complete understanding of the plants' requirements.

The best guide to such an understanding will always be a careful study of the conditions under which our cultivated plants live in their native habitat. This does not mean that the grower should attempt to duplicate these conditions; very often this is not even possible. Besides, our aim should be to improve on the natural conditions by means of adjustments that are designed to favor optimal development.

Though plants are adapted to the conditions offered by their natural environment, these conditions always include many hazards which frequently do not give the plants a chance to develop their full beauty. In cultivation, especially in a greenhouse, the environment is or can be controlled; consequently, not only can hazards be excluded, but conditions can be idealized so that all requirements are taken care of to the fullest extent.

In the following outline the genera are grouped according to growth rhythm and natural habitat, and conclusions have been drawn from these concerning treatment in cultivation. Only those genera with which I am personally acquainted are mentioned here, but the directions given

Group I. *Ramonda nathaliae* is one of the semi-hardy rock-dwelling gesneriads.
Roche

apply equally to any others which belong to the same group.

Group I. *Rock-dwelling gesneriads, some of which are semi-hardy.*

Among the semi-hardy kinds are such species as *Briggsia aurantiaca* (southern Tibet, at 12,000 feet), and members of the genera *Conandron* (Japan), *Haberlea* (Balkans), *Jankaea* (Balkans), *Opithandra* (Japan), *Oreocharis* (southeastern Asia) and *Ramonda* (Balkans, Pyrenees).

These grow in nature in the mountains, in more or less shaded, humus-filled, usually vertical rock crevices, and their requirements, therefore, are rather obvious. Good drainage of the growing medium is very important for them, because vertical rock crevices always drain well.

Whether these plants succeed outdoors or not depends largely on the amount of protective snow cover they receive before hard frosts occur. With most of them it also depends on the severity and duration of the cold period. The hardiest are *Haberlea* and *Ramonda.* For indoor growing, they require a cool greenhouse which must be shaded in summer and in which during winter the temperature can be lowered to 40° or 45° F. All definitely require a cool winter rest and usually do not flower without it.

It is rarely realized that the wild species of the African genus *Saintpaulia,* the African-violet, and those of the related Asiatic genus *Petrocosmea,* actually live under very similar conditions, usually in rock crevices. For this reason, they are included in this group. The important difference is that their habitat is truly tropical and entirely free of frost. The humidity during most of the year is high (around 90 per cent), and the temperature during the long rainy season reaches 90° F. Even during the annually recurring cooler and only relatively drier period of three or four months' duration, the temperature rarely drops below 65° F.

This explains why African-violets in cultivation are so sensitive to irregular watering, why they respond so well when their pots are equipped with wicks which extend into water-filled receptacles below, and which assure constant moderate moisture in the pot; why they are so sensitive to the dry air of the living room and to cold draughts from windows in winter.

Many soil mixtures have been proposed and recommended for African-violets, so these will not be repeated here. When grown with wicks, and with the lower receptacle containing a mild nutrient solution, vermiculite mixed with perlite is a very satisfactory medium.

The species of the genus *Streptocarpus,* with few exceptions, are also rock dwellers. Exceptions are, for instance, *S. kirki* and *S. caulescens,* which generally grow epiphytically in more or less moist forests, and *S. saxorum,* which inhabits the *Saintpaulia ionantha* region described above. All three of these give excellent results when grown in hanging baskets as described under Group V.

Most of the others grow in eastern South Africa on shady sandstone cliffs, sometimes on granitic rocks, or on rocky slopes. The soil is always a stony loam soil. Their habitats are always so oriented that they are fully exposed to the seasonal rains and to mist which drifts in from the sea or from water courses below them. In consequence, they are also habituated to a fairly constant humidity, in spite of the lower annual rainfall of the region, though they are less sensitive to dry air than the saintpaulias.

S. grandis and its relatives, which produce only one large leaf and which in nature commonly grow on steep, shady banks of earth or rock in forests, are monocarpic. This means that they die after flowering and fruiting, though it may take two years or more for the plants to mature. Repropagation from seeds is the only means of maintaining these species.

The rock-dwelling species of *Streptocarpus* in general succeed best in a gravelly sod-soil (see under Group II) mixed with pieces of charcoal, and it is notable that most of them are definitely averse to peatmoss, so this must not be included in their growing medium.

Hull

Group II. Orange-flowered *Rechsteineria leucotricha* is one of several South American gesneriads which have solid, fleshy tubers.

Chirita sinensis, which is native to southern China, also grows on stony slopes or in rock crevices but, contrary to all other gesneriads, it inhabits a semi-arid region. In fact, its thickly and stiffly fleshy leaves attest it to be a true succulent. In cultivation, it must be treated as such and should be planted in a gravelly soil to which pieces of charcoal may be added. It should be watered freely only when it is in growth and at all other times must be kept very much on the dry side. In addition, it requires ample light, without which it does not flower.

Group II. *Gesneriads with solid, fleshy tubers.*

These include, first of all, plants in the genus *Rechsteineria,* which have exceptionally large tubers; also *Sinningia* and *Chrysothemis* (*Tussaca* or *Tussacia*). All of these are native to tropical America and grow in nature in lateritic soil (a leached, acid and usually stony clay soil) which commonly has a covering of humus. The tubers in most instances are imbedded in the top layer of the clay, which is somewhat enriched with humus. As the production of tubers indicates, these plants are adapted to survive more or less prolonged periods of drought, and this must be considered in cultivation. Rechsteinerias in particular require a completely dry rest of three to four months. Most of the sinningias do also, and the large-flowered garden forms of *Sinningia speciosa*—in garden books generally called "florist gloxinia"—respond equally well if they are gradually dried off after flowering and are rested for three months. The tubers then will increase in size from year to year and will reward the grower with a display of large numbers of their showy flowers. *Sinningia barbata,* however, has no tuber and may be treated like plants of Group IV.

Plants of chrysothemis grow with preference at the foot of a cliff, where water trickles even during a large part of the dry season, and they will then produce their fist-size tubers only when drought forces them to do so. In cultivation they do it when their growing medium becomes exhausted. Until then they are likely to continue flowering from new shoots arising from the base. Besides, they also produce small tubercles in the axils of their leaf stalks, and the leaf, with its stalk and tubercle, serves as a cutting that roots readily.

The above described natural conditions suggest for these plants a clayey loam, such as sod-soil—produced by composting grass sods from a clayey soil—mixed with some leafmold, coarse sand and pieces of charcoal. This works very well but makes it impossible to exclude the ever-present nematodes, since steam sterilization of such a soil is unsatisfactory.

Rechsteineria may actually be grown entirely in a somewhat sandy gravel (steam sterilized), mixed with pieces of

Group III. *Kohleria lindeniana* belongs among the gesneriads which are characterized by scaly rhizomes. Its white flowers are tinged with purple and its purplish leaves are marked with white along the veins.

Hull

charcoal. The others, especially the sinningias, give excellent results in a mixture of equal parts of sand and shredded peatmoss. In either case, regular feeding, once a week or once in two weeks, is required and may consist in alternate applications of a weak solution of a complete chemical fertilizer, such as Hyponex, and a diluted, liquid, organic fertilizer, such as fish emulsion. Dehydrated sheep manure may also be applied in small quantities.

Group III. *Gesneriads with scaly rhizomes.*

These include the important genus *Achimenes,* also *Capanea, Diastema, Gloxinia perennis, Koellikeria, Kohleria* (*Isoloma, Tydaea*), *Niphaea, Seemannia* and *Smithiantha* (*Naegelia*), all from tropical America, and *Titanotrichum* from Formosa. These plants are also adapted to dry rest periods, their scaly rhizomes serving as storage organs.

In nature, they usually grow in depressions below wooded slopes, where humus accumulates and where even during the dry season a fair amount of moisture is retained. Some are even commonly found near waterfalls. This is an important observation, because it indicates that such plants—particularly *Achimenes* but also *Diastema* and *Koellikeria*—must never be allowed to dry out completely. The rather delicate scaly rhizomes perish if kept too dry and are best stored in boxes of peatmoss during the three or four months of rest.

The smithianthas also require three to four months of rest but, since their rhizomes are less perishable, they may be rested completely dry in the soil in which they were growing.

Niphaea, Seemannia and *Gloxinia perennis,* which produce scaly rhizomes when they are ready to flower, may be simply cut down after flowering, divided and repotted, or repropagated from cuttings.

Some of the kohlerias, most of which produce scaly rhizomes freely, behave like *Gloxinia perennis* and may be treated in the same manner. Even in nature, if conditions permit, they may skip the rest period altogether.

Hull

Group IV. Somewhat resembling an African-violet, *Boea hygroscopica* from southeastern Asia is a herbaceous plant with fibrous roots. Some gesneriads in this group are shrublike.

A few of the kohlerias, such as *K. elegans,* do not produce scaly rhizomes at all, at least not in cultivation. These should be treated as suggested under Group IV.

Titanotrichum sometimes produces—especially if it is suffering from starvation or other wrong treatment—a highly specialized structure in place of flower trusses. This is an upright branching shoot, or several such, full of small bulblets resembling scaly rhizomes.

The capaneas, most of which are vine-like, are least satisfactory in cultivation. They are shy to flower and equally slow in producing scaly rhizomes. More than the others, they seem to require a very definite seasonal change in temperature and humidity.

The most satisfactory soil for plants of this group is a mixture of equal parts of sifted sphagnum moss and peatmoss to which pieces of charcoal and a fair amount of sand should be added. Regular

Arnold

Group V. *Codonanthe macradenia* represents the trailing type of gesneriad with fibrous roots.

feeding, as recommended above for Group II, is then necessary.

Repotting into fresh soil after the rest period is essential with all the plants of Groups II and III.

Group IV. *Terrestrial gesneriads with fibrous roots.*

These plants have neither tubers nor scaly rhizomes. Some of them grow epiphytically on the branches of trees, but most frequently they are found in nature on the banks of rivers or creeks or in humus-filled depressions, where sufficient moisture is available throughout the year to sustain them in more or less continuous growth. At times they may stop growing for a week or more. This period should be observed, for watering then must be diminished, but they have no complete rest period. Their requirements in cultivation, therefore, are simple.

They are grown in pots, and any rich but readily draining humus soil suits them. To exclude nematodes, they may also be grown in a mixture of about equal parts of sifted sphagnum moss, shredded peatmoss and sand, to which pieces of charcoal should be added. Regular feeding, as recommended above, is then necessary.

This group includes both shrubby and herbaceous, mostly perennial, plants. The more or less shrubby ones are *Asteranthera* (Chile); *Fieldia* (Australia); species of the genus *Gesneria* (tropical America); *Mitraria* (Chile); *Rhabdothamnus* (New Zealand); *Rhytidophyllum* (tropical America); *Sarmienta* (Chile); and *Solenophora* (tropical America).

All the Chilean plants here mentioned require in winter a cool period of about three months at 45° to 50°F., without which they usually do not flower.

The herbaceous plants, mostly upright in growth, include *Alloplectus* (tropical America), some of them vine-like; *Besleria* (tropical America); *Boea*—also *Dichiloboea, Ornithoboea* and *Paraboea*—(southeastern Asia); *Chirita* (southeastern Asia) — except *C. sinensis* (see above) (some chiritas, such as *C. lavandulacea* and *C. micromusa,* are annuals); such upright species of *Columnea* as *affinis, aureonitens, consanguinea, lepidocaula, macrophylla, sanguinea,* etc. (tropical America); *Episcia* (tropical America), mostly creeping; *Kohleria elegans* (Costa Rica) and *K. deppeana* (Mexico), both without scaly rhizomes; *Lysionotus* (tropical Asia); *Monopyle* (tropical America); *Nautilocalyx* (tropical America); *Rhynchoglossum notonianum*—commonly known as *Klugia notoniana*—(tropical America and southeastern Asia); and *Sinningia barbata* (Brazil), without tubers. The perennials of this group may be pruned back sharply after flowering, if they become straggly, and are best repropagated from cuttings after four years.

Group V. *The trailing gesneriads with fibrous roots.*

Most of these live in nature entirely epiphytically on the branches of trees, and all of them give best results in cultivation when grown in hanging wire baskets. When correctly treated, they are among the showiest of all the gesneriads.

These include *Aeschynanthus* (southeastern Asia); *Codonanthe;* the trailing species of *Columnea* and *Hypocyrta* (*H. selloana* and *H. teuscheri* are best grown upright in pots); *Nematanthus* and *Trichantha.*

After trying many soil mixtures for

(*Concluded on page* 33)

AFRICAN-VIOLETS

Everblooming and simple to grow

Alma Wright

Roche

African-violet display globe at the home of Mrs. Kenneth Thompson, Montclair, New Jersey. Note the tiny lizard that also lives within the globe.

THE African-violet (*Saintpaulia*) has become the most popular member of the Gesneriad family because of its ease of culture, continuous flowering habit, variety of blossom forms, range of colors, and leaf patterns. In recent times no other plant has equaled it in holding the sustained enthusiasm of house-plant collectors throughout the world.

The native habitat of *Saintpaulia* is East Africa, where it was discovered in the Usambara Mountains about 1892 by Baron Walter von Saint Paul-Illaire, the Imperial District Captain of Usambara, then a section of the German protectorate of East Africa, later called Tanganyika.

Apparently seeds or living plants of two distinct species were in the original shipment that the baron sent to his father, Hofmarschal Baron Ulrich von Saint Paul-Illaire of Fischbach, Silesia, Germany. The elder Saint Paul-Illaire grew plants and gave some to Herman Wendland, Director of the Royal Botanic Garden at Herrenhausen, Hanover, Germany. Wendland described and named the genus *Saintpaulia* in honor of the Saint Paul family.

The species offer interesting plant diversion. In their wild state they have never flowered as well or grown as luxuriantly as they do in the modern home. Twenty species and several natural varieties have thus far been identified. *Saintpaulia ionantha,* one of the two original species grown, has been responsible for most of the present-day cultivars.

African-violet activity in this country began about 1927 with the cultivation of plants from seeds purchased in England and Germany by Armacost and Royston of West Los Angeles, California. By 1936 the first named varieties were offered for sale by this firm. They were: 'Blue Boy', 'Admiral', 'Amethyst', 'Commodore', 'Mermaid', 'Neptune', Norseman', 'Number 32', 'Sailor Boy' and 'Viking'.

From the start, saintpaulias have been recognized as ideal house plants, for they live and flower successfully in the average home. If there is any magic formula for culture, it is a faithfully followed program of care. Watering, fertilizing and repotting must be done with regularity and promptness if beautiful flowering plants are desired the year round. "Hit-or-miss" attention will give only mediocre results.

Light

Adequate light is one of the essential elements for the production of good bloom on saintpaulias. While protection from the hot rays of the sun must be given in spring, summer and fall, during the dark days of January and February

direct mild winter sunshine will promote flowering.

Excessively bright light gives the leaves a pale bleached look and shortened petioles. Insufficient light produces dark foliage with long petioles and sparse bloom. To find the best place in the house for correct lighting, place plants in various windows and observe the results. They will soon be evident. For symmetrical foliage, window-grown plants need to be turned regularly so that all the growing parts will get equal amounts of light.

Artificial light gardening is a most satisfactory way to grow saintpaulias, for thus they receive evenly balanced illumination. Lights should be placed approximately 10 to 14 inches over the plant table and kept on from 12 to 14 hours a day.*

Water

How often plants need to be watered may be influenced by the temperature and humidity in the room, the type of pot used and the composition of the soil mix used for potting. While watering each day may not be necessary, it is advisable to check the soil daily and to apply moisture if the soil feels slightly dry to the touch. Always use warm or room-temperature water—never cold. Cold water will cause ring spot on the foliage.

Saintpaulias will grow and flower best if the soil is kept just slightly damp at all times. A plant that is frequently permitted to get too dry will revive when it is watered but its vitality is lowered and the roots become damaged. On the other hand, saintpaulias do not like soggy soil; they should never be left standing in water. It is probable that more saintpaulias are lost from overwatering than from any other cause.

Plants may be watered satisfactorily from either the top of the pot or the bottom; it is a matter of preference. But if bottom watering is practiced it is advisable to water occasionally from the top to prevent the accumulation of mineral salts on the rim of the pot.

Soil

Saintpaulias may be grown in a great variety of soil types and mixtures. As a rule, these plants do best in soils which are loose in texture, porous and well drained, with a high percentage of organic matter. Because of their fine hair-like roots they need a substance that can be easily penetrated. It should also permit free movement of water and air, and it should always be sterilized at the time of planting.

There are several good commercial mixes especially made for saintpaulias, any of which should be satisfactory. Should they not seem light enough in texture, add a little perlite.

Temperature and Humidity

Best growth is obtained in temperatures which range from 65 to 75 degrees Fahrenheit, with 50 to 60 per cent relative humidity. Saintpaulias can endure higher and lower temperatures but they will not prosper if the air is excessively dry. If the temperature is too low, growth slows down, flowers will be sparse and of poor quality and the foliage will curl down around the rim of the pot instead of lying flat and neat. Air that is too hot and dry can cause the buds to fall off or the blossoms to drop soon after opening.

It is difficult to maintain adequate humidity during winter without the aid of a humidifier. Otherwise, grouping the plants close together, placing them on a surface of moist pebbles in a shallow tray, placing open containers of water among them, or misting with warm water will heighten the humidity.

Fertilizing

It is better to feed very small amounts of plant food each time the plant is watered than to give large applications occasionally. Use a complete water-soluble fertilizer recommended for saintpaulias and read the manufacturer's instructions printed on the label before applying. Do not over-fertilize and always be sure the soil is not too dry before using plant food.

*See the special article on fluorescent light for gesneriads, pages 13—16.—Ed.

Roche

African-violets displayed by Mrs. Fred Heger of Essex Fells, New Jersey

Propagation

New saintpaulia plants are easily grown by three different methods: leaf cuttings, plant divisions and seeds. Leaf cuttings are most frequently used. There are a number of satisfactory ways of rooting them.

Leaf Cuttings

First, remove a firm, healthy, mature leaf from any row of leaves except the old outside or bottom row. Then, with a clean, sharp knife or razor blade cut the end of the petiole on a slant to make it about 1½ inches in length. Do it carefully to avoid bruising. Set the leaf aside for about 30 minutes for the end of the petiole to heal before placing it in the rooting medium.

Some growers consider it time-saving to pot leaf cuttings directly in 2-inch individual pots of damp vermiculite. They plant the cuttings ½ inch deep, then water them. Then they either group the pots in a community pan or flat or enclose each in a small plastic bag, and place in a warm, light location to root.

Others prefer rooting cuttings in water. To do this, they fill a drinking glass or other container with water and cover the top with aluminum foil or wax paper. A hole is punched in the covering and the leaf stalk pushed through the opening down into the water. Several may be put in one glass. A few small pieces of charcoal will keep the water sweet. Should any of the leaves rot or die, the remaining leaves need to be moved to a new container with fresh water. They should all be set in a warm, well-lighted location, but not in the sun.

Roots will begin to show in from two to four weeks. When they are from ¼ to ½ inch long—before young plantlets appear—the leaves are removed from the water and planted ½ inch deep in what-

Roche

Saintpaulia 'Star Sapphire' grown and displayed by Ruth Marie Peters of Popular Gardening and Living Outdoors.

ever potting mixture has been chosen. This may be dampened vermiculite or a mixture of ⅔ damp peatmoss and ⅓ damp vermiculite or perlite. If necessary, the cutting may be supported with a small plant label or crossed plastic toothpicks to keep it firmly seated in the growing mix. As soon as young plantlets have grown an inch or so high, they are separated from the parent leaf and planted in 2-inch pots in a well-balanced soil mixture.

Some growers like to leave the cuttings in water until small plants form, but if they are kept in water too long they become water-logged and lose vigor. Potting up is done in the same manner as for rooted leaves.

For rooting a large number of leaves it may be speedier and easier to use a plastic tray, glass dish or aluminum pan filled with growing medium. Place a few pieces of charcoal in the bottom of the container. Use the larger size horticultural grade vermiculite or perlite, and have it moist. Insert the unrooted cuttings directly in the medium, lining them out in rows with the petioles ½ inch deep. Keep the medium lightly and evenly moist during the rooting period.

Aquariums, fish bowls, battery jars and large dishes also make suitable containers that will provide a uniform humid condition in which to root leaves. For artificial drainage place a thin layer of broken charcoal or sterilized stones over the bottom. Then add 3 inches of vermiculite. Do not pack it down; level it lightly and leave it fluffy. In planting the cuttings, firm the vermiculite just enough to hold the leaves upright. Use a clear pane of glass or plastic as a cover. Put in a window where it will get bright light but no direct sunshine. Keep the vermiculite damp but never wet. Ventilate by inserting a toothpick or match between the cover and the rim of the container or make a few small holes in the plastic. If excessive moisture collects on the cover, more air is needed.

Divisions and Offsets

The fastest way to obtain flowering-size plants is to propagate by plant division or by offsets (suckers). When dividing a multiple-crown plant the soil should be a little on the dry side, as the leaves will then be less brittle and the petioles not as apt to snap. Remove from the pot and separate the various plants with as little damage to the root system as possible. Repot each plant separately, being watchful that the center of the crown is above the soil line and free of any covering of soil. Water moderately. Keep the divisions a little on the dry side until new growth starts.

If offsets or suckers are to be used, they should be large enough to be handled easily. Gently work them away from the older plant and set them to root in vermiculite or other rooting medium. Until enough roots grow to hold them steady, keep them fastened down with crossed toothpicks or plant labels.

Seeds

Producing new plants from seed is a captivating experience, but it is not recommended for the average amateur. Plants grown from seeds do not come true as to variety, and a considerable amount of growing space is required.

FLUORESCENT LIGHTING

Proper illumination assured even in darkest areas

Frances N. Batcheller

GROWING plants under artificial light is a comparatively recent trend in the history of horticulture. Until the advent of fluorescent tubes, artificial light as the sole source of illumination for growing plants was neither very practical nor economical.

Practical Aspects

Fluorescent light gardening has many advantages over greenhouse gardening. A person may start in a small way, with one or two units, then (if space permits) add more as his skill and interest develop. The grower is no longer dependent on natural light sources, and does not need windows with the proper exposure. With thermostatically controlled heating, and in some cases, air conditioning, artificial light for plant growing is a logical development in this increasingly automated world. The problems of heating are less, as a living area would be heated in any case. Fortunately, most gesneriads will adapt to the usual temperatures preferred by people.

Many parts of a house, apartment or office may be utilized. Decorative units, which can be built in, may add to the appearance of the room. Attractive flowering plants can be as colorful and artistic as fine paintings. Sometimes a hallway will provide space for a light garden. For the determined grower, a large clean dry cellar or utility room is highly satisfactory. Such an area will provide good space for working and storage and for a convenient arrangement of benches for the plants. A source of water is a basic requirement for any large set-up.

It is usually possible to disassemble lighting equipment and benches if the grower decides to move, whereas a greenhouse is hardly packable.* An added advantage is that portable plug-in equipment is not subject to the same scrutiny by real estate assessors as an obviously visible greenhouse.

Size Limitation

The most serious disadvantage to growing under lights is the matter of plant size. Fluorescent lighting is very efficient and satisfactory for small or comparatively flat-growing plants—such as saintpaulias and florist gloxinias. It does not work out well for large hanging baskets of trailing columneas, episcias, aeschynanthus or similar types. These are much more successfully grown in a greenhouse. Tall plants are not very practical either under lights. However, there are so many gesneriads which can be grown to perfection by this method, that the grower has plenty of interesting material to work with. Juvenile stages of trailing plants can be used, and restarted from tip cuttings when they outgrow their alloted space.

Fixtures to be Used

The type of lighting fixtures used depends upon the available space and the grower's abilities as a handyman. For those who do not want to make their own set-up, various types of light units and carts can be purchased, all ready to use as soon as they are plugged into the circuit. Electricians can supply and install fixtures. If the grower buys the fixtures and installs them himself, making a permanent connection to his house electrical

* But see the article on a portable greenhouse in PLANTS & GARDENS for Winter 1966-67, page 35.

The House Plant Corner

From 15 to 20 plants can be accommodated in this tray, which is lighted by two 20-watt fluorescent tubes, each 2 feet long. Height of the light is easily adjusted with thumb screws.

system, it would be wise to have it inspected by a licensed electrician. If several light units are installed, they should be on a separate circuit from the rest of the house. This also facilitates connecting in a timer.

Before deciding on any fixture, remember that the longest unit possible for the bench space is the most efficient. The ends of any tube are less efficient than the center. Also the 20-watt tubes have a much shorter life than 40 or higher wattage tubes. Much practical information on equipment is given in *Fluorescent Light Gardening* by Elaine C. Cherry (Van Nostrand, 1965).

Decorative units usually require special design and may use the new fluorescent panel lights or circleline tubes. Suggestions are given in *Indoor Garden for Decorative Plants* by Henry M. Cathey, issued by the U.S. Department of Agriculture.** These decorative units may be used as display for those plants taking pride of place.

For benches containing a wide selection of plants, fixtures should be adjustable in height. Individual plants may be moved nearer the lights by placing them on inverted pots. This is also a useful device for trailing plants. The most commonly used method is to hang the light fixtures on chains, adjustment being made by S-hooks. Sometimes the fixtures are arranged on counter-weights, so they can be easily raised while working with the plants, or adjusted at an angle to accommodate plants of different heights.

Recommended Tubes

There are various types of fluorescent tubes available for the fixtures. The type normally used for household or industrial lighting—such as cool white or daylight, may be used. These have proved quite satisfactory for some gesneriads—saintpaulias in particular. They are also easy to procure in almost any area. In many large-scale research installations, these tubes are usually combined with some source of incandescent light, to provide a better balance of light rays. For the average grower, this is frequently not practical, as the incandescent lights give off so much heat that the plants may be damaged if placed too close to them.

A better solution for the home grower is the use of some of the more recently developed tubes especially designed to stimulate plant growth, such as Gro-lux. These tubes produce more red and blue light rays, which are the ones used in photosynthesis, and less of the green rays, which are comparatively useless to the plant and may even be somewhat harmful. This type of tube has been successfully used in submarines to grow fresh vegetables. These plant growth tubes also enhance the appearance of many colors, especially pinks, so they add to the effectiveness of display set-ups. A newer development is the wide spectrum tube which also includes far red rays, which have been found helpful in promoting flowering in some plants, when in proper balance with the red rays.

**See also page 40 in the Winter 1966-67 Plants & Gardens for a condensation of the Cathey booklet.

Timing the Lights

If the light fixtures are connected with an automatic timer, it is a great convenience, especially for a few days' absence. Lights are usually set to burn 12 to 16 hours a day. Some dark period is absolutely essential to the health of the plants. A drop in temperature of 5 to 10 degrees during the dark period is also of great benefit. This is sometimes effected simply by turning off the lights, as even fluorescents generate some heat, especially from the ballasts. Intensity of the light and its duration are interrelated factors. Longer hours at a lower intensity can equalize shorter hours at a higher intensity. The quality of light—the wave-lengths emitted by the phosphors (the fluorescent powders that coat the inside surface of the tube)—also influences the timing, as more efficient specialized plant growth tubes will not need to burn as long as less efficient general utility tubes.

Most gesneriads are grown at about 70–75° F. during the light period. It is likely that episcias require the greatest amount of heat, streptocarpus the least.

Bench Design

The benches or tables used under the lights should be sufficiently narrow so all plants can be reached easily. They should also be planned to be the proper size for standard fixtures—2, 4 or 8 feet or multiples of these lengths. Benches that are free-standing and open on all sides are a decided convenience and provide better air circulation and heat distribution than those placed against a wall. Thought should be given to watering methods and humidity control. The plants can be in individual saucers, in community pans or flats, or the whole bench can be waterproofed and kept filled with some material such as vermiculite or pebbles which can be kept moist. In this case the plants should be raised above the damp material on screening or metal lath to prevent overwatering and possible spread of disease. Bench, table or shelf surfaces should be covered with some waterproof material which is easy to scrub clean.

If the bench can be surrounded by a clear plastic adjustable curtain, it will keep the humidity higher, but some circulation of air must be provided or fungus disease may become a problem. Automatic humidifiers are valuable for a large setup.

Plant Culture Under Lights

The same general cultural requirements exist for plants grown under fluorescent lights as in any other growing area. However, under light growing, fertilizing and watering may become critical factors, as the light stimulates growth at a constant and rapid rate. Dilute soluble fertilizer applied fairly frequently is better than larger doses at longer intervals. Many growers use a slow release fertilizer or a dilution of liquid fertilizer of about 1/20 recommended strength for ev-

Plants can be brought into bloom in an otherwise dark room on this fluorescent-lighted cart. If the cart is placed in a bright window, only the lower tray needs to be lighted.

The House Plant Corner

ery watering. Naturally the type of growing medium used influences the fertilizing method. Inert ingredients such as vermiculite, etc., must be fed constantly, while a rich organic soil can survive more erratic treatment.

Pests should be less of a problem under fluorescent lights than in a greenhouse, as their access to the growing area is generally more difficult, but any that are introduced will spread rapidly under such favorable conditions. Highly poisonous sprays or fumigation cannot be used in living areas—so prevention is much easier than cure.

Seedlings are very easy to raise under lights. They should be grown in some kind of a closed container, such as a plastic box, so there is no danger of the tender plants' drying out, which is fatal to gesneriad seedlings. Such a container can be safely used under lights, as it will not overheat, as it would in direct sunlight. Newly germinated seed should be kept within 5 to 8 inches from the tubes. Cuttings root rapidly under lights, and these should also be kept in plastic boxes or bags, using vermiculite or other material as a rooting medium. Bags can be hung in spaces between lighting units.

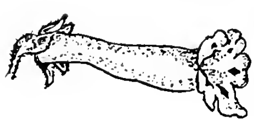
When dormant material such as tubers or rhizomes resume growth, they should be gotten off to a fast start by placing them within 5 or 6 inches of the tubes and moving them down as the tops grow. Space under the less efficient ends of the light tubes or darker edges of the benches can be used for plants which are completing their growth cycle after flowering, but still need some light to store food for the next cycle.

Plants for Perfection of Growth

As to the most satisfactory gesneriads for the light garden, saintpaulias are ideally suited to this method. Many amateurs have become commercial growers because of the superior plants they have raised by this method. Water spotting of foliage seldom occurs under lights and the foliage color and growth habit are excellent. The florist gloxinia is another plant which is grown to perfection under fluorescent lights. Episcia foliage responds very well to fluorescent light, the metallic variations showing up well. The plants will bloom well without danger of sunburning the leaves, which frequently occurs in natural light. Columneas, either the upright types which can be shaped compactly, or the small-leaved trailers, which can be hung between light fixtures or placed on inverted pots, are most satisfactory under lights. Many of the hybrids bloom continuously.

The species of *Sinningia*, especially the miniatures *S. concinna* and *S. pusilla*, are excellent subjects for the light bench, as are the low-growing rechsteinerias and gloxineras. Rosette plants like *Boea* and *Petrocosmea* are very satisfactory. Small-growing plants such as *Diastema* and *Koellikeria* provide variety. Taller plants such as kohlerias and smithianthas require more space, but bloom well under lights. Achimenes flourish under lights and can be had in bloom at any season of the year if the rest period is gradually recycled. Under natural light conditions, achimenes plants are summer blooming. Hypocyrtas and small-growing gesnerias are also excellent choices for the light bench. The rosette forms of streptocarpus are satisfactory on the light bench, but *S. saxorum* is not recommended unless grown as a foliage plant, a category it is well qualified to fill.

Persistent research with new types of tubes and experimentation by both professional and amateur growers is continuing all the time. New products and new methods will doubtless be forthcoming. Before starting your own light gardening, visit as many light growers as possible to benefit from their experience and profit by their mistakes. ◆



GESNERIADS IN THE GREENHOUSE

The successful grower takes advantage of the micro-climates under glass

Cornelius Ackerson

THE acquisition of a greenhouse opens up so many interesting avenues to the serious gardener that it is easy to over-extend oneself. The best solution is to concentrate on plants which have attractive growth and bloom, are relatively easy to obtain and grow to perfection, and which fit into the climate of a specific greenhouse. The gesneriad family is ideally suited to most greenhouses.

Climates and Micro-climates

The word "climate" has special importance in a greenhouse. The various types of heated structures used for growing plants are divided into cool, intermediate and warm greenhouses.[1] Most gesneriads, being tropical plants, do best in a warm greenhouse with a 70-degree night temperature, but many do as well in an intermediate house at a 60-degree night temperature. As an even further breakdown of the word "climate," even within a greenhouse maintained at a thermostatically controlled temperature, there are micro-climates. Areas near heating sources become warmer than the set temperature; plastic-covered houses permit less air infiltration, with a resultant higher humidity. Many other factors such as tree shade, reduction of solar energy due to smog, and also greenhouse orientation with respect to sun, add to the variables which produce micro-climates. In nature these micro-climates are found on a larger scale, to the extent that certain orchids which grow well at one elevation will not survive in the same general area which may be only several hundred feet higher or lower. Gesneriads in the greenhouse react in a similar manner and the successful grower adapts the various members of the family to the micro-climates within his greenhouse.

Pot and Basket Plants

The 120 or more genera and 2,000 species of gesneriads may be classified in various ways, but for cultural purposes in a greenhouse I prefer to divide them into pot plants and hanging basket plants.

Most of the columneas, some kinds of alloplectus, all of the hypocyrtas and many of the episcias do very well in hanging baskets. All of the florist gloxinias, rechsteinerias, sinningias, smithianthas, streptocarpuses and most kinds of achimenes are best grown as pot plants. This by no means exhausts the gesneriad potential for a greenhouse, but those genera are always found in any representative collection. The African-violet (*Saintpaulia*) is almost in a class by itself from a cultural standpoint, for it requires less light than other members of the *Gesneriaceae*. This makes it an ideal house plant.

Set-up for a Greenhouse

My glass greenhouse contains two center benches filled with sand, one side bench containing soil and an east side bench which has sand automatically watered to provide constant moisture for potted plants. A rear addition was built especially for orchids and it has an automatic water spray system which comes on whenever the thermostatic control actuates the motorized roof ventilators. In

[1]See Brooklyn Botanic Garden's "Greenhouse Handbook for the Amateur," PLANTS & GARDENS Vol. 19, No. 2, for more information about greenhouse operation.

Ackerson

Scene in author Ackerson's greenhouse

addition, a fan at the front end of the greenhouse, also wired in series with the thermostat, blows a stream of air between the center bench and the east side bench, past the spray system and into the orchid section. This combination of air flow, morning light on the east side bench and the humid atmosphere above the moist sand makes this area ideal for most gesneriads. The hanging basket types are suspended from a rail below the roof above the east side bench.

This brief tour of my greenhouse describes conditions as they now exist after many years of gesneriad culture. It didn't happen all at once, for I had failures and successes which built up the experience which makes gesneriads now one of my favorite families of plants.

Handling the Plants

When I get a new fibrous-rooted gesneriad of pendent habit, I put it in a hanging basket, while a tuber or scaly rhizome is placed firmly in the moist sand of the east side bench to await signs of growth. As soon as green top growth and evidence of root development can be seen, I pot the plant and then bury the pot up to its rim in the moist sand in the bench. A season of growth determines whether it is worth keeping and whether it is best grown in a pot or in a hanging basket.[2]

The art of hanging basket culture goes back many years and has become quite traditional. English-style baskets made of wire in a hemispherical shape are the most common, but a gardener can make his own square baskets by folding quarter-inch galvanized hardware cloth into open-top boxes in various sizes.

Sheet moss[2] is universally used as basket lining material. It grows in shady wooded areas on fallen logs and rocks in sheets about a quarter-inch thick. When first put in the baskets it is green, but it soon turns a pleasing brown.

Hanging baskets demand little care but they do require water quite frequently—more in summer, and particularly during hot sunny periods. I have a three-foot piece of copper tubing on the end of a rubber tube connected to a faucet in my greenhouse. With this I can reach into each basket and water it thoroughly. Any excess will drain off. Without special treatment, however, the soil tends to crust on top and water does not penetrate to the roots. I have found that Aqua-Gro Granular,[3] when mixed with the soil, preserves the loose, porous structure that is required for absorption of moisture.

Soil Mixtures

Potting soil can cause more arguments than any other phase of gesneriad culture. Every grower seems to have a special mix, although gesneriads seem to do well in any loose mixture which holds moisture, yet drains readily. For those who need small amounts and do not wish to bother with soil and manure, the following formula, developed by Professor Ray Sheldrake of Cornell University, is excellent:

[2]Baskets of various types, also sheet moss, may be ordered from Jupiter Manufacturing Co., Box 297, Kearney, New Jersey 07032.

[3]Obtainable from Aquatrols Corporation of America, 217 Atlantic Avenue, Camden, New Jersey 08104.

milled sphagnum peatmoss	1 qt.	
horticultural vermiculite	1 qt.	
fine sand	1 qt.	
ground limestone	1 tsp. (level)	
superphosphate (20%)	½ tsp.	
potassium nitrate	¼ tsp.	

Ammonium nitrate may be substituted for the potassium nitrate at the same rate.

My greenhouse operations require large quantities of potting soil. Years ago I built a 6-foot-square open-top structure out of 4-inch cinder blocks. I started with good topsoil and I constantly add weeds, vegetable refuse and spent potting soil. Before using this I sift it through a quarter-inch mesh screen and add well rotted horse manure and perlite. This latter material is indestructible, white, inert and is excellent to make the soil loose and keep it friable during the relatively long growing season of most gesneriads. Exact proportions are not important as long as the moist resultant mix just holds together when squeezed into a ball. I then sterilize the compost, about a cubic yard at a time, by pouring a bottle of Larvacide into holes made in the pile. A plastic cover is then put over the pile and left on for a week.

Ackerson

Tuberous and rhizomatous gesneriads such as episcias and gloxineras are started in moist sand. As soon as growth is evident: "I pot the plant and then bury the pot up to its rim in the moist sand of the bench."

Protective Measures

Insect control in a greenhouse is usually obtained by fumigation or spraying. I have used both methods, but found that fumigation does pose some hazards. Isotox garden spray is excellent as an all-purpose spray. I have also found the systemic insecticide Systox to be very effective. When put on top of the soil in pots and baskets, this is absorbed by the plant roots to become a fluid which is toxic to all insects that feed upon the plant's tissues. Since it is human nature to delay spraying until insect damage is noticed, I believe more and more greenhouse owners will turn to the systemic method of protection against these pests.

Gesneriads do not seem to be prone to rusts, mildews and other diseases, but both Ortho rose and garden fungicide, containing Phaltan, and Greenfield's rose and ornamental disease control, containing Pipron, are handy to have available if there is evidence of disease in the greenhouse.

A 20-20-20 liquid fertilizer is used in my orchid-feeding program. I put the pots in a large pan of the solution and then drain them over another pan. When I am through I have three or four gallons of fertilizer solution which I use on the gesneriad plants.

One final point which deserves mention, although details are covered elsewhere,[4] is the ease with which hybrid gesneriads may be produced in the greenhouse. No horticultural experience is more thrilling than to cross a sinningia with a rechsteineria and produce an × *Gloxinera*. In the large Gesneriad family, the possibilities are endless. ◆

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[4]See page 72.

DICTIONARY OF GESNERIADS

Frances N. Batcheller

NEARLY sixty of the best genera in the Gesnoriaceae are given brief descriptions here. For a classification of these and close to sixty others, see page 80. In the entire gesneriad family there are about 150 genera.

Achimenes—see special article, page 37.

Aeschynanthus (*Trichosporum*). Fiborus-rooted plants with mostly trailing stems, generally epiphytic in habit. The somewhat succulent smooth leaves have entire margins. The flowers are tubular, generally red or orange, although some species have inconspicuous greenish flowers. The fruit is a long thin pod, sometimes a foot or more in length; the seeds are hairy on the ends. There are about 170 species, native to southeastern Asia and the Himalayan region. Some species are called "lipstick-plant" from the appearance of the red bud emerging from the fused calyx.

A. parvifolius (*A. lobbianus*) with fused maroon calyx and *A. pulcher* with green calyx, are similar red-flowered species. Both have creamy-yellow throats that are just visible deep inside the flowers. Both also have thin ovate leaves. *A. marmoratus* has leaves patterned with maroon, a greenish flower and very narrow separate calyx segments. Its leaves are its chief ornamental feature. *A. speciosus* is a robust plant with orange flowers. *A. micranthus* is a smaller plant with dark red flowers. 'Pullobia' and 'Black Pagoda' are hybrids which are more floriferous than any of the species.

Graf

Aeschynanthus pulcher

Agalmyla. Similar to *Aeschynanthus*, but distinguished by having two rather than four stamens. There are several species, native to the East Indies.

Graf

Agalmyla parasitica

Alloplectus. Shrubs or vines. The flowers are generally clustered in the leaf axils, with bracts. The calyx is large in comparison to the corolla and frequently showy in color. The flowers are red or yellow, cylindric, contracted in the throat, with small regular lobes. There are about 80 species in Central and South America and the West Indies, but few are in cultivation.

A. capitatus has large green leaves and tightly clustered yellow flowers with bright red calyxes. *A. vittatus* has a similar inflorescence but has handsome maroon foliage

Ack rson

Rechsteineria macropoda

(For description of this group, see page 51.)

with light veins. *A. ambiguus* and *A. domingensis* are vining plants with smaller leaves and yellow flowers.

Asteranthera. A semi-hardy creeping shrub with red flowers. It is distinguished from the related *Sarmienta* and *Mitraria* by a bilabiate corolla and two small bracts on the flower stem. There is only one species, *A. ovata,* from Chile.

Bellonia. Small shrubs with white rotate flowers. There are two species from the West Indies.

B. spinosa is the only gesneriad with thorns.

Besleria. Shrubs with fibrous roots. The leaf pairs are equal in size. The corolla is campanulate or urceolate, sometimes spurred, white, yellow, orange or red in color. The fruit is a berry. About 170 species, Central and South America and the West Indies.

B. lutea, with small yellow flowers, is sometimes grown. It is a man-high woody plant, though its variety *imrayi* is classed as a herbaceous perennial.

Boea. Herbs with leaves frequently in a basal rosette, often woolly. The corolla tube is very short. The flowers are blue, white or pink. The fruit is a twisted capsule. There are about 20 species, native to a wide area from Burma to Australia.

B. hygroscopica is a small plant with attractive blue flowers with considerable resemblance to saintpaulias.

Briggsia. Semi-hardy alpines, generally stemless herbs with slender rhizomes. The flowers are yellow, occasionally spotted with red. The corolla tube is inflated, the lower lip larger than the upper. There are about 20 species from the Himalayas and China. Of these, the best known is *B. muscicola.*

Capanea (*Campanea*). Shrubs with scaly rhizomes. The large flowers are borne in an inflorescence of long-stalked axillary clusters. The corolla is campanulate with a wide throat, greenish or sometimes pink. The calyx is ribbed. There are 10 species native to Central America and northern South America.

Everett

Besleria lutea

Graf

Chirita lavandulacea

Chirita. A large genus of diverse plant types. Many species are quick-growing annuals with watery stems. The flower is generally funnel-shaped and blue, white or yellow. The fruit is a linear capsule, not twisted. It is distinguished from the allied genus *Didymocarpus* by the notched stigma. There are about 90 species in India, China and southeastern Asia.

C. lavandulacea has blue flowers, large leaves and stout watery stems. *C. micromusa* is smaller and similar in vegetative aspect, but has bright yellow flowers. *C. sinensis* is a slow-growing plant with thick leaves in a basal rosette, sometimes strongly marked with a pattern of silver; the flowers are lavender. *C. asperifolia* is shrubby in habit with showy purple and white flowers of a waxy texture.

Chrysothemis. Tuberous-rooted erect herbs with large toothed leaves. The ribbed tubular calyx is colorful and persistent. The small flowers are yellow with red stripes and borne in clusters in the leaf axils. There are about six species, from the West Indies and Central and South America.

C. friedrichsthaliana has a yellow-green calyx. *C. pulchella* has an orange calyx.

Codonanthe. Trailing epiphytic plants with succulent glossy leaves, sometimes red-spotted on the lower surface. The corolla is spurred, with a long cylindric tube, white or pink in color. The fruit is a berry. About 15 species from the West Indies and Central and South America.

C. macradenia and *C. crassifolia* are similar species with white flowers.

Columnea—see special article, page 34.

Conandron—Semi-hardy alpine. Leaves in a basal rosette. The rotate corolla is white, lilac or pink with a darker center. The stamens are united in a cone. There is one species, *C. ramondioides*, from Japan.

Corallodiscus. Semi-hardy alpines. Leaves in a basal rosette, veins deeply indented on upper surface. Calyx segments divided to the base, corolla, of blue, white or purple, with a lengthened tube and two rows of hairs on the inside. About 18 species, native to the Himalayas and China.

Cyrtandra. Shrubs or small trees. Leaves frequently leathery, sometimes whorled, sometimes in unequal pairs, cordate (heart-shaped) or lanceolate in shape. Inflorescence clustered in axils, frequently with bracts. Corolla tubular or funnel-shaped, generally white but sometimes yellow or red. Fruit a leathery berry. Largest genus in the family, with over 600 species. It also has the widest geographic range, occurring from southeastern Asia to many Pacific Islands, including Hawaii.

Everett

Chrysothemis friedrichsthaliana

Graf

Codonanthe crassifolia

Diastema. Small herbs with scaly rhizomes. The white or purple corolla is small and tubular, with regular lobes, frequently dotted. There are about 40 species in Central and South America.

D. vexans has soft-textured leaves and white flowers with purple dots on the lobes. *D. quinquevulnerum* has stiffer bright green leaves with prominent veins and pinker spotting on white flowers. *D. maculata* has very dark green leaves and a lavender flower. *D. rupestre* has very small white flowers in long-stemmed clusters.

Didymocarpus. Very similar to and sometimes combined with *Chirita.* Main distinction is in the entire stigma and in the capsule dehiscing on both sides. Leaves generally pubescent with serrate edges. Flowers funnel-shaped, blue or rarely yellow. About 100 species, India and Malaya.

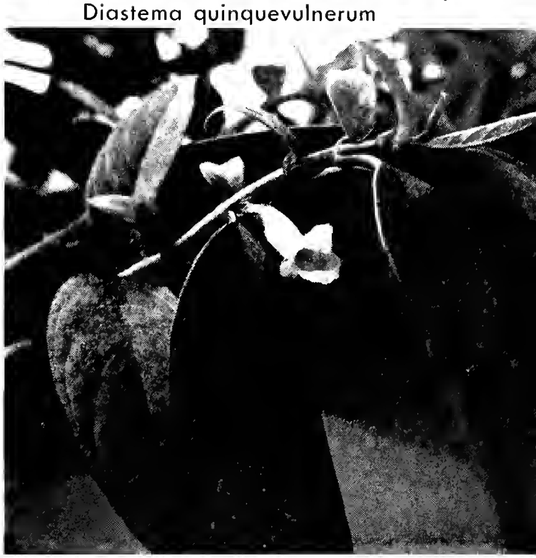
D. vestitus and *D. aurantiacus* are sometimes grown.

Drymonia. Shrubby or vining plants. The leaves are usually long-petiolate. The calyx is large and leafy. The white or yellow flowers are showy, usually paired or solitary in the leaf axils. The corolla is funnel-shaped, not contracted in the throat, with a bilabiate limb, the lobes sometimes fringed. Fruit a berry. About 35 species, Central and South America.

D. stenophylla with narrow leathery leaves and cream-colored flowers is in cultivation.

Graf

Diastema quinquevulnerum



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Drymonia stenophylla

Graf

Gesneria cuneifolia

Episcia (includes *Centrosolenia* and *Paradrymonia*)—see special article, page 30.

X Eucodonopsis. A hybrid between *Achimenes* and *Smithiantha.* A number of desirable hybrids are available.

The Kartuz hybrids 'Arundel' and 'Tintagel' have large attractive white-woolly aromatic leaves and purple flowers in terminal racemes.

The Cornell hybrids, which offer considerable variety in leaf type and flower color, are 'Treasure', 'Sterling', 'Aristocrat', 'Royal', and 'Sunshine'.

Gesneria. Low herbs or shrubs. Distinguished from most other gesneriads by alternate rather than opposite leaves, which are frequently glossy. The plants are fibrous-rooted. The calyx lobes are narrow, the tube ribbed. The corolla may be cylindric, funnel-shaped or campanulate, with the lobes sometimes reflexed. There are about 35 species, native to the West Indies.

G. cuneifolia is an attractive small plant with rosette leaf arrangement and orange-red flowers. *G. acaulis* also has red flowers, but larger, less attractive foliage. *G. christi* has red flowers and a more crinkled leaf. *G. pauciflora* has orange flowers. *G. pumila* has white flowers. *G. citrina* has a more erect growth habit and yellow flowers. *G. ventricosa* is a shrubby plant with handsome red flowers.

X Gloxinera. Hybrid between *Rechsteineria* and *Sinningia.* See special article, page 49.

Gloxinia. This is the botanical *Gloxinia,* a genus of erect perennial herbs, mainly from northern South America, characterized by knotty, scaly rhizomes. The several species vary in flower color and arrangement.

G. perennis has reddish cordate leaves and purple campanulate flowers borne in a terminal raceme.

Haberlea. Hardy alpine. Distinguished from *Ramonda* by the funnel-shaped, two-lipped corolla. The leaves have a less dense covering of hairs. There are two species, both from the Balkans.

H. rhodopensis and *H. ferdinandi-coburgi* are similar, both with lilac flowers. 'Virginalis' is a white-flowered form of the latter species.

Hypocyrta. Trailing or upright plants, easily distinguished from other gesneriads by the unusual pouched flowers of red, orange or yellow. There are about 10 species, native to Central and South America. A number of very desirable species are in cultivation.

H. nummularia is a small trailing plant with small leaves, sometimes deciduous, and

Graf

Gloxinia perennis

red flowers with a black and yellow line around the narrow throat. Nodules much like tubers are sometimes formed on the stems. *H. wettsteini* is stiffer in habit, but still somewhat trailing. The small leaves are very shiny and the waxy, long-lasting flowers are red with yellow lobes. *H. perianthomega* is woody, with curious yellow-green flowers striped with maroon. The showy orange calyx is persistent. *H. radicans* is trailing, with very glossy oval leaves and large orange flowers. *H. nervosa* has red flowers, larger than those of *H. nummularia,* and sharply pointed leaves with a sparse covering of white hairs. *H. teuscheri* is large and shrubby, with yellow flowers and attractive leaves, the markings resembling an episcia pattern. *H. strigillosa* is trailing and has dull-finished pointed leaves and orange flowers. *H. selloana* is stiff and erect with large leaves and brick-red flowers.

Jankaea (sometimes considered a species of *Ramonda*). Hardy alpine with purple flowers. Differs from *Haberlea* by its short bell-funnel-shaped, not two-lipped corolla. Leaves have a coating of silvery hairs. Difficult to grow. One species, *J. heldreichi,* from Mt. Olympus.

Graf

Hypocyrta nummularia

Graf

Haberlea ferdinandi-coburgi

Koellikeria. Small herb with scaly rhizomes. The leaves are arranged in a basal rosette and are attractively spotted with silver. The small white and red flowers are borne in a terminal raceme. One species, *K. erinoides,* native to Central and South America.

Kohleria (*Isoloma, Tydaea*). Herbs or shrubs, mostly with scaly rhizomes, upright growth habit and generally hairy stems and leaves. The tubular flowers may be red, orange, yellow, pink or purple, marked with darker lines and spots. There are more than 50 species, ranging from Mexico to northern South America.

K. amabilis, a pink-flowered species, is low-growing and has attractively mottled foliage. Another small species is *K. lindeniana,* with lavender and white flowers, also with patterned foliage. *K. eriantha* is tall with large red-orange flowers. The bright green leaves are edged with red hairs. *K.*

Graf

Koellikeria erinoides

Graf

Kohleria lindeniana

Graf

Nautilocalyx forgetti

Graf

Lysionotus serratus

bogotensis has very dark green leaves and brilliant red and yellow flowers. *K. elegans*, which does not form rhizomes, has a more graceful growth habit than most kohlerias and has attractive orange flowers on long pedicels. Some of the most desirable hybrids are 'Cecelia', with watermelon-pink flowers, 'Rongo' with everblooming brilliant magenta flowers and 'Longwood' with extremely large strawberry-red blooms.

Lietzia. Tuberous, tall erect plant. Corolla yellow-green, with wide mouth and two basal protuberances. One species, *L. braziliensis,* from Brazil.

Loxostigma. Herbs. Corolla tubular, yellow, spotted. Long seed-pod with hairy seeds. Three species, India and China.

Lysionotus. Plants with smooth rhizomes. Corolla tubular or campanulate, white or purple. The fruit is a linear capsule with hairy seeds. Three species, from China, Japan, the Himalayas.

L. serratus has thick stems and smooth leathery green leaves with white veins. The flowers are lavender. *L. pauciflora* is a semi-hardy alpine with narrow notched leaves in a basal rosette and cream-colored flowers.

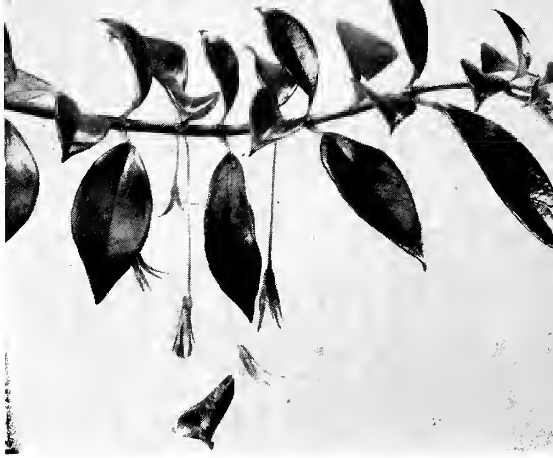
Mitraria. Small-leaved creeping shrub with red flowers, semi-hardy. The corolla has small lobes. It is distinguished from *Sarmienta* by the one-sided bract surrounding the calyx. One species, *M. coccinea,* from Chile.

Monophyllaea. Succulent herbs with one large cordate leaf. Flowers grow from the leaf base as in unifoliate *Streptocarpus,* and are borne in scorpioid racemes as in *Rhynchoglossum.* There are seven or eight species, from Thailand, Malaya and the Philippines.

Monopyle. Herb with leaf pairs decidedly unequal in size. The inflorescence is terminal and the corolla is campanulate. About six species, Central and South America. *M. maxoni* is in cultivation.

Nautilocalyx. Erect herbs with inflorescences of clustered flowers and bracts in the leaf axils. Flowers are pale yellow or white. The corolla is nearly cylindric, hardly contracted and broad-lobed. Twelve species, native to South America.

N. bullatus has dark green quilted foliage. *N. forgetti* has attractive green leaves with red veins. *N. lynchi* has deep red shiny leaves. *N. villosus* has leaves covered with white hairs. These plants are frequently grown as foliage plants, although the flowers are also attractive, resembling episcia blooms.



Arnold

Nematanthus longipes

Nematanthus. Shrubs with entire fleshy leaves. The flowers are on long pedicels and funnel-shaped with reflexed lobes. There are six species from Brazil.

N. longipes has bright red flowers. *N. fluminensis* has pink flowers and prominent red veins on the underside of the leaf.

Niphaea. Small herbs with scaly rhizomes. The corolla is rotate, white or purple in color. There are four species from the West Indies and Central America.

N. oblonga has a white cup-shaped flower and attractive yellow-green leaves with prominent red veins.

Opithandra. Semi-hardy alpine with rounded leaves in a basal rosette. The tubular flowers are purple or white. There is one species, from Japan, *O. primuloides,* which is sometimes cultivated.

Oreocharis. Semi-hardy alpine rosette plants. The corolla has an almost straight tube

Monophyllaea horsfieldi

Graf

Graf

Petrocosmea kerri

and nearly regular limb, purple or yellow in color. There are about six species, from China and the Philippines.

Paliavana. Tall shrubs. The corolla tube is short, with a wide throat, yellow-green in color. Two species from Brazil.

Petrocosmea. Small plants with leaves in a basal rosette. The corolla has a short tube, very similar in shape to saintpaulia, white, yellow or purple in color. There are about 20 species native to China, Burma, and Thailand.

P. kerri has white flowers with yellow markings. *P. parryorum* has purple flowers.

Phinaea. Low herbs with scaly rhizomes. The corolla is white and cup-shaped. It is distinguished from *Niphaea* in having the filaments longer than the anthers. There are about seven species, from the West Indies, Central and South America.

P. multiflora is a small species with silver-veined leaves and small flowers.

Platystemma. Small rhizomatous herb with only one pair of leaves. The corolla is much like *Saintpaulia*. One species, *P. violoides*, from the Himalayas.

Ramonda. Hardy alpine. The hairy leaves are borne in a basal rosette. The rotate flowers are purple, pink or white. This is the most frequently grown hardy gesneriad. There are three species.

R. myconi from the Pyrenees has sharp-pointed yellow anthers. It is the more common species. *R. serbica* and *R. nathaliae* from the Balkans have anthers with blue coloring and blunt tips.

Rechsteineria— see special article, page 49.

Rhabdothamnus. Small shrub with birch-like rounded leaves, long internodes. The campanulate flowers are orange or yellow. There is one species, from New Zealand, *R. solandri*.

Rhynchoglossum (*Klugia*) Watery-stemmed herbs with very asymmetric leaves. The small dark blue and white flowers are borne in a scorpioid raceme and are distinctly two-lipped. This is the only gesneriad to occur in both Old and New Worlds, but belongs to the Old World grouping. There are about 15 species, from India, Malaya, Indonesia, Philippines and Central and South America.

R. notonianum is a spreading plant which

Everett

Seemannia species

blooms prolifically and needs a great deal of water. The calyx is inflated.

Rhytidophylum. Herbs or shrubs, allied to *Gesneria.* The leaves are in alternate arrangement, frequently in terminal tufts, usually hairy, sticky or rugose, sometimes aromatic. The inflorescence is many-flowered, cymose. The corolla is contracted in the center of the cylindric tube. Flowers are yellow-green or reddish.

Saintpaulia—see special article, page 9.

Sarmienta. Semi-hardy creeping herb with small glossy leaves. Distinguished from other allied Chilean genera by having only two fertile stamens. The red urn-shaped flowers are constricted at base and below lobes. There is one species, *S. repens,* from Chile.

Seemannia. Herbs with scaly rhizomes. The leaves are usually whorled, at least on the upper part of the stem. The flowers are red or yellow, campanulate, with small lobes. There are about eight species from South America.

S. latifolia has narrow bright green leaves and showy red-orange flowers on long stems. *S. sylvatica* has several color variations and has wider leaves.

Sinningia—see special article, page 49.

Smithiantha (*Naegelia*). Herbs with scaly rhizomes. The foliage is cordate, sometimes enhanced with bronze or red coloring. The funnel-shaped flowers with small lobes are borne in terminal racemes. About four species from Mexico.

S. zebrina, with yellow and red flowers, is the species most often grown. Compact forms are available. *S. cinnabarina* has exceptionally beautiful velvet-textured red leaves and orange flowers. Hybrids in the Cornell series are outstanding for their wide color range, floriferous habit and large flowers.

Solenophora (includes *Hippodamia*). Shrubs with opposite, rather coarse, large leaves. The large funnel-shaped flowers are red, yellow or white. About ten species, Central America.

Streptocarpus—see special article, page 45.

Titanotrichum. Herb with scaly rhizomes. The showy tubular yellow flowers with crimson throat are borne in a terminal raceme. There is one species, from China, *T. oldhami,* which does not produce seed, but can be propagated by the rhizomes or the whip-like aerial propagules which are produced from the leaf axils.

Graf

Titanotrichum oldhami

Schulz

Smithiantha cinnabarina

EPISCIAS

Peacocks of the gesneriads

Peggie Schulz

THE metallic or jewel-toned leaves of some episcias, combined with the rainbow of colors in the flowers of various kinds, make episcias the peacocks of the gesneriads. Leaves may be of clear silver, bronze, iron-blue over bronze or emerald green, or they may be decoratively veined in contrasting brown, willow-green, silver, cream or rose. Undersides of leaves may be of identical colors or of a complementary tone such as wine or near pink. One species has pebbled reddish-brown leaves with mulberry-red undersides.

The tubular flowers come in a galaxy of colors—salmon, pink, scarlet, orange, yellow, magenta and white. A few are bicolored and the white ones have purple-brown freckles inside the tube.

Healthy episcia plants can be expected to flower abundantly from early spring to late fall. This trait, plus their engaging manner of growth, makes them popular as pot and basket plants in both house and greenhouse. New plants appear almost continuously at the tips of stolons or runners, much as in strawberries.

The "Inside" Story

There are about 35 species of *Episcia* endemic to southern Mexico, Brazil and the southern island of the Lesser Antilles. The name *Episcia* is from the Greek word *episkios,* meaning shaded. In their natural environment these plants grow mainly in shaded areas.

Episcias are low-growing herbaceous perennials, generally stoloniferous. The hairy, elliptic to ovate leaves appear in pairs opposite each other, or in three-leveled whorls on short petioles. Flowers are axillary—that is, they appear in the angle between the leaf and stem—and are borne either singly, in pairs or in four-flowered clusters. Segments of the five-parted calyx may be either green or colored. The corolla is funnel-shaped to tubular-campanulate, or narrowly bell-shaped. The five lobes are rounded, margins are toothed or fringed and the limb is spreading or oblique. Normal flowers have four stamens, abnormal flowers often have five to eight, and the filaments are united with the base of the corolla tube. One dorsal gland makes up the disk at the base of the superior ovary. The style elongates as it ages, becoming longer than the stamens after they have shed their pollen. The stigma is mouth-shaped or bilobed. The more or less ovoid fleshy fruit is a two-valved capsule with small brown or black seeds.

Hull

***Episcia punctata* has ivory-throated white flowers with fringed petals and red spots. Leaf surface: silvery wool.**

Episcia Culture

Episcias are often called "flame-violets," just as the related saintpaulias are known as African-violets. Their culture approximates that of the saintpaulias.

Although their botanical name suggests a shady situation, most episcias grown indoors do better when given more light than is favored by African-violets. If they are grown for foliage only, they can be kept in a north window, but if flowers are also wanted, they should have an east or a lightly shaded south window. Under fluorescent lights, there should be approximately 4 to 6 inches between tube and pot rim. They need 14 to 16 hours of light daily. The thin-leaved types cannot take as much natural or artificial light as the thicker-leaved types. If leaves start bleaching, reduce the light by moving plants to another window or farther from light tubes.

Any porous well-drained soil which grows good African-violets or begonias will do nicely for episcias, or they can be grown in inert material such as perlite, gravel or vermiculite. Fertilize healthy, soil-grown plants about twice a month. Plants grown in inert material (if they are in good health) should be given a one-fifth strength fertilizer solution with every watering.

Episcias need more water than many other gesneriads. This does not mean drowning them or letting them stand in water, but merely keeping the soil well moistened with water at room temperature. If water is splashed on the leaves, the plants should be kept out of the sun until they have dried, for sun shining on sparkling drops of water burns leaves. I treat episcia soil with Aqua-gro, to help it accept and retain water.

Humidity needs to be kept high for bumper crops of flowers. The minimum should be 45 per cent, maximum 75 per cent. It is not difficult to heighten humidity in a greenhouse, but in a window garden it may pose a problem. An automatic humidifier is most efficient. Other methods include misting plants daily, setting them on saucers of moist sand or pebbles, or lining pots with moistened sphagnum moss.

These tropical plants take kindly to the temperatures we human beings favor—70 to 75 degrees Fahrenheit during the day with a slight drop at night. Temperatures below 55 degrees Fahrenheit may give the plants a setback that proves fatal.

Episcias may be grown in any conventional pot, basket or broad, flat container, the size depending on the plant size. A squatty 4-inch pot will accommodate one plant with a few stolons. I often use wooden flats, cake tins or bulb pans, then let the container fill with foliage before any of it trails over the edges. I find that flowering is increased when I keep stolons clipped on any kind of planting. Of course this has to be done with discretion, for a few stolons add a highly decorative appearance to the plants.

Episcias are subject to all the pests and ailments that afflict other gesneriads, but with good culture they may never be bothered with any problems. A weekly spraying with a house-plant aerosol bomb will provide extra insurance.

Episcia Displays

Because episcias thrive in high humidity, terrariums are much to their liking. They make spectacular plantings for bubble bowls, bottles and glass pitchers. A footed cake container with a plastic lid makes a marvelous episcia display piece.

Episcias are exciting plants for training up a vertical moss stick or over a horizontal one placed in a low, flat container. They are pretty, too, grown in a strawberry jar or an epergne.

When growing episcias in containers lacking a drainage hole, about an inch of charcoal pieces placed on the bottom will keep the soil sweet.

Propagation and Renovation

Stolons, leaves and seeds may all be used for propagation. Stolons and leaves can be rooted in horticultural vermiculite or in perlite, sand, sphagnum moss or any other medium you may prefer. Stolons root easily in water, too. While it takes but a short time for a plant to develop from a stolon, the leaves are rather slow in rooting. Covering the cutting with a drinking glass or a plastic bag will hasten rooting.

Roche

Episcia cupreata occurs in many varieties, with leaves of vivid green, brown and silver, or in other combinations as a backdrop for the scarlet flowers.

Episcias are easily grown by sprinkling the seed on any of the materials recommended for starting cuttings. Set the planting in a pan of warm water until the surface material is moist. Cover the planting with glass or plastic, set in a light but not sunny place. Germination should take place in two to three weeks. After seedlings appear, move the planting to an east window or place it 2 or 3 inches from fluorescent lights. Start transplanting seedlings when leaves touch. Set them individually into 2-inch pots of growing mixture or collectively into community pots. A single sowing of mixed seed should provide a handsome lot of colorful plants.

If you want to grow your own seed, touch the stigma of one flower with pollen from another. Better try several crosses for they do not pollinate as easily as most gesneriads. The seed ripens in six weeks during spring and summer but it may take up to twelve weeks in the winter.

When stolon-producing episcias grow straggly and have long "necks" hanging over the pot edge, renovate them by cutting off the old plant with about an inch of stem, dust the cut end with rooting hormone then root it as suggested for cuttings. Slip a drinking glass or plastic bag over the bare-necked root in the pot, keep it watered and it, too, will soon send out lush, new foliage.

Species and Varieties

In addition to the 35 species there are dozens of episcia varieties. Here are capsule descriptions of a few favorites.

E. reptans (*E. fulgida*): Pebbled bronze leaves marked with willow-green veins.

E. cupreata: There are many varieties of this species, but 'Viridifolia' with glossy green leaves and large scarlet blooms is the best of the flowering type. 'Chocolate Soldier' has silver markings on a chocolate background, orange-red flowers. 'Silver Sheen' has silver leaves with darker margins and light red flowers.

E. lilacina: Soft, hairy, dark bronze-

Schulz

Episcia reptans grown by the author.

Schulz

Episcia dianthiflora, a neat and appealing plant with fringed white flowers and small succulent leaves. For its use as a hanging basket plant, see page 64.

green leaves, sometimes patterned with green; pale lavender flowers with yellow throats. Some of the hybrids between *E. cupreata* and *E. lilacina* have deep pink flowers. 'Pinkiscia', one of the first, is a pretty plant. 'Ember Lace', a sport of 'Pinkiscia', has white and pink variegations on its metallic green leaves.

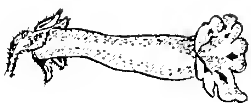
'Tropical Topaz': Shiny green leaves, bright yellow flowers.

E. dianthiflora: Small, succulent green leaves and feathery-edged white flowers with speckled throats; a shy bloomer.

E. punctata: Gray-green leaves, white, fringed flowers. Although not as neat a plant as *E. dianthiflora,* it is a good bloomer.

E. melittifolia: Strong, upright-growing plant with a square stem and long, narrow, glossy brown leaves with reddish undersides. Flowers are magenta.

Some of the newer ones are 'Fire'N' Ice', silver leaves, bright red flowers; 'Painted Warrior', silver leaves tinged pink, margined dark green, orange-red flowers; and 'Velvet Brocade', with quilted rose-pink leaves margined with green and large dark red flowers. ◆



CULTURAL NOTES

(*Continued from page* 8)

these plants in baskets, we have found equal parts of sifted sphagnum and peat-moss mixed with pieces of charcoal most satisfactory. Every two weeks the plants receive a light application of liquid fertilizer as recommended above.

To keep the soil in place while still permitting free aeration, we line the wire baskets with osmunda fiber. A plastic net (if necessary in several layers)—*not* a plastic sheet—may be substituted for the osmunda.

Most important in the culture of such plants in baskets is correct and carefully timed watering, avoiding their ever drying out completely. Though their fleshy leaves and succulent stems are an adaptation to periods of drought, this is merely an expedient, and they do not require a dry rest period. The only exception known to me is *Columnea flaccida,* which actually sheds its leaves before flowering and must then be kept dry. All the others merely arrest their growth from time to time for a week or more, at which periods they should be watered only sparingly. When in growth, they should be watered freely.

After three years, such trailing plants usually become straggly and are then best repropagated from cuttings.

Gesneriads in general (with very few exceptions) are shade loving, but not to such an extent that sunlight must be completely excluded. Morning sun is definitely beneficial, but the hot noonday and afternoon sun of summer must be guarded against. In northern winters shading will often be entirely dispensable.

The average winter temperature for tropical gesneriads in heated greenhouses should be about 65° to 70° F. during the day and 55° to 60° F. at night. ◆

COLUMNEAS—FOR VERSATILITY

Brilliant flowers and decorative leaves in great variety

M. Carleton L'Hommedieu

TWO full centuries were to pass after the official naming of the first columnea before a species was commercially listed in the United States. In 1753 the name *Columnea* was established by Carl Linnaeus for this member of the *Gesneriaceae* in honor of the Italian botanist, Fabius Columnea (Fabio Colonna, 1567-1640). Plant explorers reported several columneas discovered during the 1700's, but no one took any horticultural notice of them. Their lack of popularity arose from the fact that the flowers were few, small and bloomed only once a year. *Columnea hirta* was the first of the genus to be reported in England after being found in Costa Rica in 1865, but it was not listed commercially in the United States until 1953.

Since then, largely through a project carried on at Cornell University, the columneas have become popular indoor plants in the United States. Through cytogenetic studies made by Dr. Robert E. Lee, in conjunction with taxonomic studies of Dr. Harold E. Moore, Jr., columnea hybrids have been developed. Eighteen of these, known as the Cornell hybrids, have been introduced to the trade.

Hull

The upright red flowers of *Columnea arguta* are characteristic of the genus.

Natural Growth Habits

Columneas are fibrous-rooted plants that grow on trees in extremely humid regions of the West Indies and Central and South America. The annual rainfall where they are found sometimes reaches several hundred inches. Even during the dry season there are light rains daily.

In habit of growth, some columneas are trailing, others spreading or upright. Their foliage varies considerably in leaf form, size and color, but it is always highly decorative. Some have tiny button-like leaves, others lanceolate or elliptical ones that vary from 1 to 6 inches in length. They are borne along the stem in unequal pairs that may be strongly dissimilar or nearly alike in size and shape. Some of the leaves are glossy and pointed, while others are soft and downy. A few species and hybrids, such as *C. arguta* and 'Banksii', sometimes have leaves in whorls of three, two the same size and the third one smaller. Generally they are this way on only one or two stems of the plant, but I have seen an entire plant of *C. arguta* with the leaves in threes.

The brightly colored tubular flowers,

Hull

The fine-textured foliage and pendent habit of *Columnea microphylla* make it one of the most satisfactory of plants for a hanging basket.

borne in the axils of the leaves, number from one to six on a stem. They range from 1 to 3 inches in length, and may be red, yellow, orange or pink. In form they so closely resemble the fantail goldfish that the common name of "goldfish-plant" has been bestowed.

Cultural Requirements

Although the columneas will tolerate a cooler temperature than most of the other gesneriads, they grow best at 55 to 60 degrees Fahrenheit and like a 10-degree variation between night and day temperature.

They will flourish in the home window or under fluorescent lights quite as well as in the greenhouse or conservatory. The slender-stemmed or vining types are best used for hanging baskets. The woody upright ones make ideal plants for the window sill.

Since columneas are epiphytic by nature, they are not too demanding as to the container in which they grow. In fact, they will grow in a very shallow pot or even fastened to a slab of pressed osmunda fern fiber which can be hung on a wall. However, this method requires special care as the slab should be soaked every week in a 20-20-20 water-soluble fertilizer, using ¼ teaspoon per gallon of water.

To achieve good results on the window sill, there are definite cultural requirements for columneas. There they should be grown in pots or azalea pans, 2½ to 3 inches in diameter. My own preference is for pans, which may be clay or plastic. The added weight of a clay pot is often beneficial in keeping the plant from falling over, especially when it gets top-heavy.

Columneas require about the same amount of light as the saintpaulias. In winter, a sunny window with full exposure is best, while placing them on the shaded part of a porch or hanging them under a tree gives excellent results during the summer.

They need a light, well-drained soil, one that will dry out readily after being well watered. For the average home grower, a soilless mix is more satisfactory than a soil that varies each time it is prepared.

A good soilless mix, called the 1-1-1, the formula of which was released by the Nassau County Extension Service in New York, contains equal parts of shredded peatmoss, vermiculite, and perlite with ½ pound of limestone added to each bushel of mix. A slow-releasing fertilizer, called Mag-Amp,* is added to this at the rate of ½ pound to each bushel. Mag-Amp has a 7-40-6 formula and generally lasts for six months after potting. Since the fertilizing elements are released only through watering, plants must be thoroughly watered when using this mix.

There are a number of other soilless mix combinations, such as the U. C. (University of California) and the Cornell mixes.

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* Marketed by W. R. Grace & Co., Baltimore, Maryland.

Buhle

'Yellow Dragon' is a sturdy, everblooming hybrid columnea.

If you find it difficult to obtain a slow-releasing fertilizer, the soilless mix used by Lyndon Lyon, noted hybridizer and grower of columneas at Dolgeville, N. Y., can be recommended:

3 qts. brown sphagnum peat, screened
2 qts. Terra-Lite (horticultural vermiculite)
1 qt. Sponge-Rok (perlite)
2 level tablespoons ground limestone

With this mix he uses a constant feeding program of ½ teaspoon of Hyponex to 1 gallon of water at each watering.

Ordinarily a pot plant in the home needs watering about every other day. The plants dry out more readily as they become root-bound. Water for columneas should always be at room temperature to avoid spotting the foliage.

As with other plants, columneas have their insect problems. Cyclamen mite is one of the worst enemies in crippling this plant. However, a systematic spray schedule with Cygon controls this insect along with such pests as aphids, which seem to appear when the plant is in flower. Plants should always be taken out of the house when being sprayed and left on a warm porch or other outside enclosure until dry. The spray, like other water used, should be at room temperature.

The Choicest Kinds

There are a number of good species and hybrids that the average person will find pleasure in growing. Any of the following will do well in the house. Others can be easily grown in a greenhouse or conservatory.

From Michael Kartuz of Wilmington, Mass.

Plants of upright growth for windowsills: 'Butterball' and 'Flamingo'.

Plants of spreading habit for baskets: 'Anna C.' and 'Eagles'.

From Lyndon Lyon, Dolgeville, N. Y.

Everblooming hybrids of the trailing type: 'Early Bird' (the best everblooming one so far). Other noteworthy hybrids: 'Yellow Dragon', 'Betty Stoehr' and 'Yellow Gold'.

From Cornell University

Small upright growers: 'Campus Queen' and 'Aurora'.

For hanging baskets: 'Campus Sunset'.

Among the larger-growing Cornell hybrids that are better for the greenhouse or conservatory, I would suggest 'Campus Gem', 'Red Arrow' and 'Cascadilla'. ◆

Arnold

Erect-growing *Columnea illepida* has heavily striped tubular flowers.

ACHIMENES

Something old, something new, something borrowed, something blue

Paul Arnold

ACHIMENES plants have been around for a long time but a good many indoor gardeners have never heard of them. Conservatories in England have been host to these tropical American wild flowers continuously since 1778 when *Achimenes erecta** with its many golden-throated bright scarlet flowers was imported from the island of Jamaica.

The happy arrival of five additional and greatly different *Achimenes* species that reached England in 1841-1843 inspired hybridizers, both professional and amateur, to improve on nature. Among these newcomers to horticulture was *A. longiflora*, with enormous vivid blue flowers, from Guatemala. Two other arrivals from Guatemala were *A. pedunculata* with orange flowers and *A. hirsuta* (*A. skinneri*) with bright red flowers. From Mexico came *A. grandiflora* with vivid purple flowers while Brazil contributed the white flowers of *A. multiflora*.

The continual arrival of additional species of *Achimenes* from the New World spurred the work of hybridizing, and soon nurserymen in France, Belgium, and England were offering 50, 60 or more varieties of *Achimenes* in their catalogs. About the turn of the century, interest in achimenes began to wane in Europe. Cultivation virtually ceased during World War One, when the use of coal and other fuel in greenhouses was restricted to the production of food plants.

Anyone who has seen a graceful basket of *Achimenes longiflora* flaunting its great blue flowers or the purple elegance of a flower of *A. patens* balanced in its green calyx with tapered spur upraised like a ballet slipper will wonder why such attractive plants as these would ever go out of style. If exploited they could easily be made as popular as petunias.

In the United States today, the arrival of additional new *Achimenes* species and the introduction of live material of sorts previously known only as dead plants in herbaria, have spurred a talented group of hybridizers. There is a revival of interest in Europe, too, particularly in England and in Germany, but the really great enthusiasm for this lovely cousin of the florist gloxinia is being shown in the United States. The increasing popularity of gesneriads for cultivation indoors has kindled an interest in the relatives of the African-violet for growing in the home, under fluorescent lights, and in the hobby greenhouse.

Form and Color Choices

Achimenes are frequently grown in hanging baskets, in pots or on a shelf or in wall niches, and sometimes in outdoor terrace containers where their trailing stems can produce cascades of flowers in late summer. Upright growing types are also available, some, from 6 inches to a foot in height, being suitable for the window sill or for growing indoors under fluorescent lights. Other species reach a height of a yard or more, making a spectacular display with judicious staking. The great majority of achimenes

* The correct name, by reason of prior usage, for a plant most recently grown as *Achimenes coccinea* but also known at different times by other discarded botanical synonyms, including: *Cyrilla pulchella, Achimenes pulchella, Achimenes rosea, Achimenes pyropaea, Trevirania coccinea, Buchneria coccinea,* as well as a host of meaningless common names such as monkey-faced pansy, hot-water plant, widow's tears, etc.

Arnold

Flowers of the tall-growing *Achimenes* 'Master Ingram' have long orange tubes surmounted by broad, deep red lobes.

plants, however, are of medium height with trailing stems that gracefully drape to display their lovely flowers.

Springing from the axils of the leaves, the flowers of achimenes have borrowed all the colors of the rainbow except green. There are pure white flowers, white ones with gold throats, some with a dot or line of color on each corolla lobe. Purple and lavender shades predominate but rich as well as pastel tints of red, yellow, orange, and blue are offered as well as various combinations, blends, and patterns. The flower size ranges from less than a half-inch in diameter to more than 2 inches across the face. The smaller kinds make up for their size by producing many more flowers, sometimes five or more on a common peduncle. Flower shapes are generally tubular to funnelform, some nearly 2 inches long, all with a flaring limb or face and with throats of various size and shape.

Culture and Propagation

Achimenes belong to the "automatic propagator" class of gesneriads that produce scaly rhizomes underground. In addition, they may be readily multiplied like other gesneriads by root divisions, by stem and tip cuttings, even by single leaves or parts of leaves stuck into a moist rooting medium. But new plants are usually grown from the scaly rhizomes. Normally three to five of these propagules, looking like tiny pine cones or birch catkins, are planted in a 4-inch pot and barely covered. During the summer flowering season the rhizomes multiply and, after the plants go dormant in the fall, the rhizomes may be harvested to yield five or more for every one that originally was planted. Most growers, however, leave the rhizomes in their pots until time to replant them the following spring.

Unlike the rhizomes of *Smithiantha* and *Kohleria* and certain others, which will perish if not kept slightly moist while dormant, the achimenes propagules can be kept quite dry. They must, however, be protected from freezing and usually are stored at temperatures in the range of 60 degrees F. The dealers start making shipments in early spring as soon as the mails are safe from freezing.

Any good, loose, sterilized soil mixture found suitable for growing African-violets or other gesneriads may be used for achimenes. Vermiculite, perlite, and peatmoss are generously used by most growers. Soil acidity seems to be unimportant but some calcium appears to be required for plants that often grow in nature in crevices of limestone rocks. This need is readily supplied by the use of sand, gravel, or oyster shell in the soil mixture. The use of animal manures, even dehydrated types, should be avoided. Supplemental feeding during growth is recommended, using any of the completely soluble plant foods according to manufacturer's directions.

There is one special requirement for growing achimenes, and failure to meet it may be the reason why some inattentive growers have not succeeded in flowering the plants indoors. The soil in which achimenes plants are growing must *never* be allowed to dry out while the plants are in growth and flower or they may go dormant prematurely. This need for constant moisture supply to the roots may require watering the plants twice a day or

Arnold

Popular since the 1850's, 'Violacea Semi-Plena' is a dwarf, compact achimenes with good-sized deep purple flowers.

more in very hot and dry weather or under conditions of insufficient shade. Otherwise, achimenes may be grown in full sun or deep shade, indoors or outside, but a cool greenhouse is preferred by most growers who have extensive collections of varieties. In states bordering the Gulf of Mexico, achimenes may be seen growing year after year in ground beds on the shady sides of houses, where they endure the winter without being lifted.

Popular Achimenes Varieties

Achimenes plants are inexpensive, ranging in price from $2.50 a dozen to three or four dollars for a single rhizome of one of the rarer sorts. One grower offers a "beginner's collection" of three each of four different kinds for two dollars. A great many of the choicest kinds may be purchased at the rate of three for a dollar and all of the following varieties are in that price range.

Compact plants for pots

'Ambroise Verschaffelt', a Swiss hybrid popular since 1854, outstanding for the tracery of purple veining on the white face.

A. andrieuxi, a dwarf plant under 6 inches in height with bell-shaped violet and white flowers.

'Atropurpurea', deep reddish-purple flowers with lilac throats.

'Camillo Brozzoni', many small pale purple flowers with white throats.

A. cettoana, long narrow dark green leaves on 10-inch branching stems, bluish flowers of a color new to achimenes.

'Charm', warm pink flowers on upright plants.

'François Cardinaux', lavender and white flowers in profusion.

'Violacea Semi-Plena', semi-dwarf with deep purple flowers.

Intermediate-height plants for pots or baskets

'Adelaide', an ideal basket plant with many large gold-throated lavender flowers.

'Cattleya', pastel orchid-blue flowers.

A. flava, pure golden-yellow flowers of moderate size on rangy plants.

A. grandiflora, purple flowers with white throats, sturdy stems and attractive red-veined leaves.

A. heterophylla, bright orange flowers on upright stems.

'Mme. Geheune', large reddish-purple flowers with red-dotted golden throats.

'Patens Major', early and easy to flower with smaller purple blooms than the species.

'Pulchella', a hybrid of *A. erecta* with larger, paler red, and more numerous flowers.

'Purple King', well named most popular achimenes in the U.S.A., very floriferous and dependable.

'Vivid', spectacular basket plant covered with flowers having orange tubes and magenta faces.

Tall Achimenes types

A. antirrhina, long slender yellow tubes ending in a vivid scarlet face.

'Lady Lyttelton', late blooming with multicolor purple flowers having open golden throats.

'Master Ingram', distinctive long orange tubes ending in erect limbs of velvety deep red substance.

A. pedunculata, the tallest achimenes, blooming late with fiery orange flowers, dotted and lined with bright red.

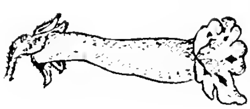
Graf

Achimenes skinneri (A. hirsuta) of Guatemala is one of the five widely differing New World species that tempted hybridizers when they first reached England in the early 1840's. It contributed flowers of vivid red to the inspired breeding programs of the period, while the other four had blue, orange, purple and white to offer.

Three variant forms of natural species, collected by Professor Harold E. Moore, Jr., Director of The Bailey Hortorium, have been introduced by Cornell University. One of them, assigned the cultivar name *A. antirrhina* 'Red Cap', has unusually large flowers of a color described as "currant red." A pale form of *A. heterophylla* having vivid yellow flowers has been given the name 'Yellow Mist'. An unusual form of *A. grandiflora*, outstanding for compact stems and for the pink rather than purple flowers, was named 'Pink Lady'.

Among the several achimenes hybrids released in 1966 is 'Cornell Jewel' (*A. antirrhina* × *A. grandiflora*), the flowers of which have a yellow tube with a limb that blends from red to orange. The plant stands out in any collection because of the red-colored stems and petioles and bright red undersides to the leaves, showing through as red veins on dark green.

Other achimenes hybrids produced in the United States include the outstanding 'Wetterlow's Triumph' from Massachusetts, with huge pink flowers, and 'Peach Blossom', a compact, warm pink flower bred by K. F. Borges in Florida. Lyndon Lyon, the well-known African-violet raiser of Dolgeville, New York, has produced several achimenes hybrids of note. Outstanding among them is 'Yellow Beauty', with enormous blooms on fairly compact plants. Park Seed Company of South Carolina recently marketed two semi-double achimenes with very tiny flowers and has some later hybrids that are currently undergoing evaluation. Achimenes seems to be coming into popular favor again after a century of neglect. ◆



PLANT HUNTING IN THE TROPICS

The amateur botanical explorer can make a valuable contribution to science while on a fine vacation

Thomas E. Talpey

> "Never to have seen anything but the temperate zone is to have lived on the fringe of the world. . . . Not to struggle and economize and somehow see the tropics puts you, in my opinion, in the class with boys who could never scrape together enough pennies to go to the circus. They never wanted to badly enough, that's all."
>
> David Fairchild
> "Exploring for Plants"
> Macmillan, 1930

PRESENTING as it does both a temptation and a challenge, this often-quoted bit of philosophy from one of America's famous plant hunters of the twentieth century strikes close to the heart of the question, "Why go plant hunting?"

To visit a rain forest where one can see scores of different fern species in less than an hour's walk, to study a palm trunk with perhaps fifty different kinds of plants growing on it epiphytically, or to seek out the native habitat of plants belonging to the family of one's special interest—these are some of the joys of plant hunting. Add to these the zest of exercise in the fresh air, the experience of meeting and getting to know new people and a different way of life, the stimulating diversion of a vacation away from familiar surroundings, and the sense of accomplishment after a successful search for a particular plant, and you will have adequate reasons to scrape together enough pennies to visit the tropics.

Plant hunting to the gesneriad fancier is usually synonymous with a visit to the tropics, for perhaps 90 per cent of the *Gesneriaceae* are native to regions within 20 degrees of the equator. In cultivating these plants we have learned to imitate growing conditions which are found naturally in the tropics: humid shady banks, along streams in shaded ravines and mountain valleys, or under the canopy of a rain forest. Generally it is this kind of region which one must seek if he wishes to find gesneriads in their ancestral homes.

Preliminary Planning

The preparation for such a trip should begin months in advance, for the prospects of success will be greatly enhanced by knowing what to expect upon arrival. Standard reference works on the region should be consulted for lists of plants known to be growing there, for specific localities, and for plant descriptions.* I have found it helpful, too, to read the narrative and descriptive accounts of travelers and naturalists who have visited these regions, as these aid in building up a background of impressions of the territory and familiarity with the customs.

Correspondence in advance with local

* An excellent starting point for locating such references might be a visit to the local library to consult the "Geographic Guide to the Floras of the World" by S. F. Blake and A. C. Atwood. The original edition of this useful catalog, published in 1942 by the U.S. Government, is now out of print but a reprint has been supplied (1963) by Stechert-Hafner, Inc., in New York City.

plant society members, horticulturists and botanists can be rewarding, for such people can provide general advice and often will know the precise spot where the object of the search can be found.

Maps, too, are invaluable in making advance plans as well as providing a format for notations which will be useful to carry along on the trip. Topographical maps are best, although often rather difficult to obtain beforehand. As a preliminary substitute I have found that ordinary road maps are useful. These are available on request from the touring service offices of the major oil and gasoline companies.

The timing of a trip can be important. For reasons of personal comfort it is well, if possible, to avoid the local rainy season. Moreover, the rain usually stimulates gesneriad flower formation so that for a month or two *after* the rainy season there are likely to be more plants in bloom. However, most gesneriads produce a few flowers from time to time throughout the year, so timing should be relegated to a consideration only and not allowed to be a determining factor.

Accommodations

I shall not dwell on travel arrangements and hotel accommodations, as a travel agent can best advise on these. It is desirable, if feasible, to have a small rental car available upon arrival, in order to visit places off the normal tourist paths to which special transportation would otherwise need to be arranged. If you venture far from traditional tourist areas, be prepared to spend the night in something far short of a luxury hotel. As an extreme example I recall one hotel where my wife and I had to brush a horde of tiny ants from our bed and spray the room with insecticide before climbing into bed ourselves for the night. Always keep mosquito repellent handy, as tropical mosquitoes can be quite persistent and annoying.

Photographic Techniques

If you are planning to photograph the plants you find, check your technique well in advance. Flowers picked and transported to the hotel for photographing usually present a noticeably wilted appearance, so it is better to photograph them in the field. This, however, can lead to problems with backgrounds and with motion during close-up exposures. A roll of dark cloth carried in the camera bag is one way of supplying an uncluttered background. Another is to shoot from such an angle that the background is either in deep shadow or far enough behind the plant to be well out of focus.

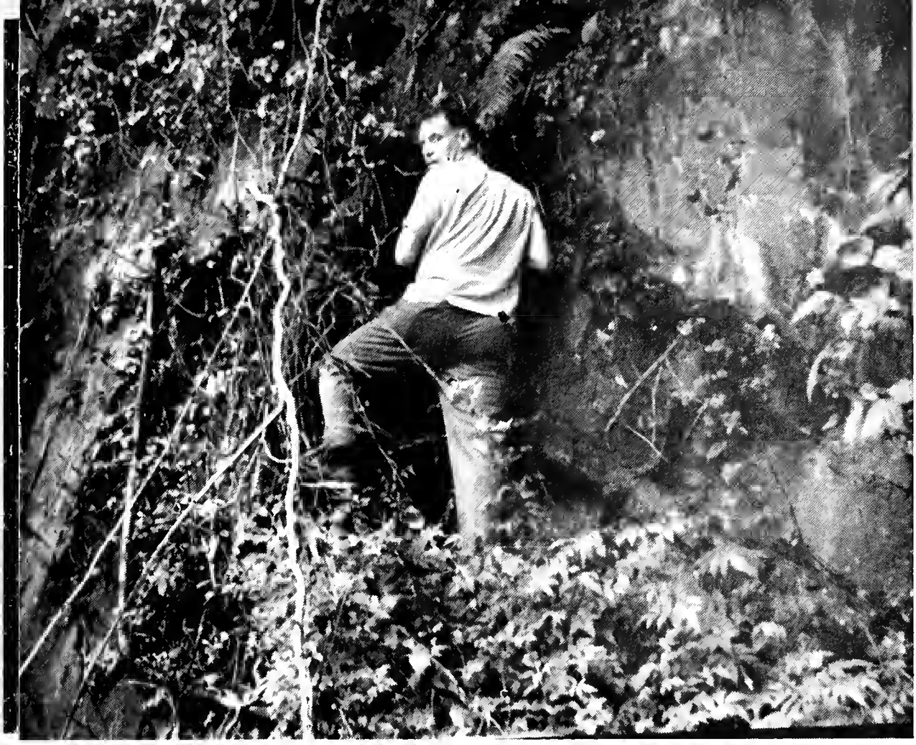
Many of the plants you wish to photograph will be growing in shaded places where the natural light will be quite weak and a flash of some sort may be required. An inexpensive solution to the equipment problem is available in the form of a small fixed-focus close-up camera such as the Kodak Star-Tech, designed primarily for medical and dental photography. A description of a similar camera, as well as the technique for using it, appeared in *The Gloxinian* magazine for July/August 1966.* The important point for the amateur is to work out a technique well in advance and then stick with it in the field.

I can strongly advise investing a few dollars per year for insurance on the photographic equipment you take with you. Then you will be at least partially soothed should you drop a filter in a mountain stream or inadvertently leave a camera behind in a restaurant—both of which I must confess to having done myself.

Bringing Back Plants

If you plan to send or bring back living plant material, except seeds, an importation permit is required. It must be

*Additional pointers on close-up nature photography can be found in "The Complete Book of Nature Photography" by R. Kinne (Barnes & Co., 1962), in the Kodak Data-Guide series or in such magazine articles as "Instant Close-ups" in *U.S. Camera,* May 1965.



Katzenberger

Thomas Talpey in search of gesneriads on a cliff in the West Indies

obtained in advance by writing to the U. S. Department of Agriculture, Plant Quarantine Division, 209 River Street, Hoboken, N.J. 07030, for an application. There is no charge for this permit.

Do not attempt to bring in any plants with roots (other than carefully cleaned orchids) since bits of soil will cling to the roots and the plants will surely be rejected at the incoming inspection station. In any event, the risk of importing a potentially dangerous strain of nematodes is far too great when propagation from leaf or tip cuttings will serve for most gesneriads. Take along a supply of plastic bags for this purpose. Well-cleaned tubers or rhizomes can be imported for those plants which form them. With these, as well as with cuttings, the plants must be fumigated on arrival and this process is liable to take its toll.

For this reason, and to avoid the inconvenience involved, it is far better to bring back gesneriads by means of their seeds. There are no restrictions on these and they can be easily carried with you with enough left over to share with your plant-growing friends. Small plastic pill bottles with snap-on caps make excellent containers for collecting seeds in the field, although the seed capsules should be spread out to dry on a tissue or paper towel back in the hotel room at night. (Don't let the maid throw out your precious treasure in the morning!) Label each batch promptly with date, name and locality; don't depend on your memory for this vital information. In collecting seed pods, select ones which have just started to dry and turn brown or which have just begun to open, although a few slightly greener ones can be collected for good measure. If too green, however, the seeds will be immature and will fail to germinate. Berries on such plants as columneas can be collected as soon as they are plump. They should then be squashed and spread out for drying.

Help from Herbaria

One of the first places to visit on arrival in an unfamiliar region for plant

hunting is the herbarium connected with a local university or museum. By examining the dried plants in such a herbarium and making notes on them you will learn what to look for in the field and be better able to identify your plants. The herbarium sheets will also give locations for the specimens. Note particularly the altitude, if it is given, for this will help in narrowing down the search. The botanist in charge of the herbarium will be able to help in pinpointing localities and perhaps can help you compile a list of gesneriads known to be growing in the region. A list of herbaria grouped according to location is published from time to time by the International Bureau for Plant Taxonomy and Nomenclature, Utrecht, The Netherlands. It is entitled "Index Herbariorum" and the latest edition (5th) was compiled in 1964 by J. Lanjouw and F. A. Staflen.

Getting Specific Directions

Before starting off into the countryside for the actual plant hunting, get specific directions to the spot you wish to visit. For example, when you finally get to that dam after having been told that your plant grows near it along the river bank, knowing whether to hunt upstream or downstream can save you an hour's frustration—the voice of experience here again!

Another inconvenience you may encounter in some countries is a difficulty in making yourself understood in a foreign language. Lacking someone to go along as interpreter, it is best to look upon the situation as a challenge and take along a pocket dictionary to use in emergencies. The natives will appreciate your willingness to try and, although there may be smiles and other evidences of amusement at your performance, they will generally stick with you until you have the information you wish.

In any event, make certain that the person you ask along the road understands exactly where you wish to go, and even then treat his directions with suspicion. It has been my experience that while arm-pointings are generally accurate, distances are often considerably longer in the traveling than one is led to believe by the natives. They will not purposely mislead you; it's just that they try to be as pleasing as possible and would rather see you happy at being close to your goal than to send you on your way discouraged at having so far to go.

Dried Specimens for Reference

In addition to photographs and seeds you may wish to bring back dried specimens of the plants you find. These can be used at your home for further study of the plants, or they can be given to a nearby institution to add to the herbarium collection or to exchange with other institutions. To collect plant specimens you will need a plant press, available through any large natural science supply distributor,* and you should plan to take along a few stiff sheets cut from a corrugated cardboard carton as well as a supply of newspapers to be used as separators between the plants. When a specimen is collected in the field it is placed carefully between the folds of a sheet of newspaper, first being inspected for insects which might eat the leaves. A few identifying notes are placed beside the plant before it is sandwiched with the other specimens and clamped into the

(*Concluded on page* 48)

*Such as Ward's Natural Science Establishment, Inc., Rochester, N.Y. 14601.

Excellent descriptions of the preparation and preservation of specimens for an amateur herbarium collection can be found in William Hillcourt's "Field Book of Nature Activities" (Putnam 1950, pp. 274-283), in "Hammond's Guide to Nature Hobbies" by E. L. Jordan (C. S. Hammond, 1953) and in the section "Exploring the Plant World" in Vol. 10 of the Book of Popular Science (Grolier, 1963, etc.), found in many school and public libraries. You may also wish to look up A. S. Hitchcock's "Field Book for the Local Botanist" (Wiley, 1931) or "A Field Collector's Manual in Natural History" published in 1944 by the Smithsonian Institution.

STREPTOCARPUS

Among its 150 species are a few that will tolerate frost

R. D. A. Bayliss

THE varied and colorful group of gesneriads known as *Streptocarpus* has found increasing favor, not only with the horticulturist, who finds them easy of culture, but also with the botanist and hybridizer.

The story of their discovery and development begins in 1826 when a plant that had been collected by James Bowie on the estate of George Rex at Knysna in South Africa was brought into flower at Kew Gardens. It was named *Didymocarpus rexi.* Two years later, Lindley created the genus *Streptocarpus* (*streptos* = twisted, *karpos*=fruit) and renamed the plant *Streptocarpus rexi.* It was nearly 30 years before another species (*S. polyanthus*) was collected in Natal and eventually also flowered at Kew.

From then on, numerous new species were discovered and described.* Inevitably, it was not long before the hybridizer realized the great possibilities of systematic breeding. The chief stimulus seems to have been with the introduction of the orange-flowered *S. dunni* in the 1880's. The subsequent crossing of *S. dunni* with two pale blue species (*S. polyanthus* and *S. woodi*), with further back-crossing, has produced hybrids in a wide color range.

How They Are Classified

Streptocarpus may be divided into four main groups, both vegetatively and geographically. While in South Africa all native species are stemless, East Africa may claim both stemmed and stemless kinds. In West Africa and Asia, however, all are caulescent, or stemmed. The shape of the mouth of the corolla tube is a distinguishing mark in certain groups of species.

The plants that have erect stems bear stalked leaves in opposite pairs. Among the species are *S. holsti* and *S. kirki* of East Tropical Africa and *S. orientalis* of Thailand.

Some of the stemless plants of South Africa have the mouth of the corolla tube laterally compressed. These include *S. bauderti, S. gracilis* and *S. comptoni.*

Stemless plants in which the mouth of the corolla tube is *not* laterally compressed are divided into two groups: (a) those with solitary leaves, such as *S. dunni* and *S. fanniniae* of South Africa and *S. michelmorei* of Rhodesia; (b) those with leaves in a rosette, such as *S. meyerei, S. rexi* and *S. parviflorus,* all of South Africa.

Streptocarpus Habitats

Streptocarpus plants in their natural state may be found in varying situations from the eastern slopes of the Drakensberg mountains in South Africa at an altitude of 1,000 to 2,000 feet to the shade of overhanging rocks in open ground. Some species prefer forest shade; others may be found on stream edges.

This genus is at its best during the warm season and predominates in the moister and more humid areas, preferring summer rainfall with temperatures of from 65° F. to 80° F. Frost is tolerated by the hardier species and the writer has collected *S. meyeri* in areas given to heavy frost for up to six months annually. The mountainous areas of Rhodesia,

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* Phillips, in his "Genera of South African Flowering Plants," published in 1926, refers to some 100 described species; 40 years later this figure has risen to nearly 150 recognizable forms probably qualifying for specific rank.

Schulz

Streptocarpus saxorum, a small-leaved species

Nyasaland and parts of East Africa harbor a number of species where favorable conditions exist but as we progress northward, the altitude (where incidence occurs) increases to 8,000 feet.

Cultivation of Streptocarpus

A group of humus-loving herbs, having a shallow rooting system, they have readily adapted themselves to greenhouse conditions when given their basic requirements. All species will grow there to perfection, but let not the beginner be dismayed if some species die after flowering and (we hope) seeding. There are some 20 such monocarpic members of the genus—plants which die after setting seed—and these, for rapid seed-to-flower growth, can be thoroughly recommended. However, most species are perennial, and even these, particularly the rosulates, or rosette-forming plants, may easily be flowered within six months of seed sowing.

Plants with solitary leaves do not, as a rule, flower until the second season. For those enthusiasts favoring these, the assuredly exotic-appearing types, *S. dunni* is the most spectacular. The single leaf may grow to 24 or more inches in length and half as wide, is strongly veined and of velvety grey-green appearance. This solitary leaf develops from one of the cotyledons (the other dying off) and it keeps developing from the base throughout the life of the plant. In nature, the tip of the leaf gradually dies back but, no doubt because of constant care, on the cultivated plant it does not so do. The flowers are large for the genus, measuring about 1½ inches long, and are brick red.

Another of the single-leafed species worth growing is *S. fanniniae* from Natal. The many flowers range from almost white to sky blue.

S. vandeleuri is one of the largest-flowered of the South African species. Not often seen in collections, it is well worth seeking. The flower stem may be over a foot in height and bears large ivory-white flowers with yellow-green markings in the throat. The solitary leaf has a hairy surface and, being bullate, or puckered between the veins, has a quilted appearance.

From the large to the small: *S. rimicola,* another member of the unifoliate

group, develops one leaf to some 3 inches followed by a second and smaller leaf. The flower is white. Sometimes an area low in the throat is covered with purple hairs; these are, however, not normally seen.

Species recommended as satisfactory horticultural subjects apart from those previously mentioned are:—

S. polyanthus—flowers mauve, a perennial with one or two leaves.

S. gardeni—with about five leaves in a rosette. The flowers are pale green outside, the limb pale violet, the lower lobes marked with purple streaks.

S. primulifolius—bearing mauve flowers with a reddish flush in the throat.

S. meyeri—a rosette of broad, softly hairy leaves, stemless, with pale blue to purple flowers.

S. parviflorus—also a rosette, having larger leaves than the above. The flowers are white with a yellow stripe inside the tube.

S. bauderti—similar in appearance to *S. meyeri* while only in leaf but the bluish-mauve flowers are larger.

How to Start New Plants

The quickest method of commencing a collection of streptocarpus is by obtaining divisions of known species or, alternatively, by leaf cuttings.

Growing from Leaves

A good soil mixture for leaf cuttings is 40 per cent peat and 60 per cent rough sand. Any section of the leaf will grow but initially it might be advantageous to lay the main veins on the mixture and pin down. If damping-off occurs, place the stems into the soil mixture at an angle of 45 degrees. Soil should be continually damp but *not* saturated. A bell glass or greenhouse atmosphere is advantageous to quick rooting. Bottom heat speeds up root growth and this, combined with a mist spray, may produce rootlets in 10 to 14 days. Nicking the underside of the vein often helps rooting but may also lead to rotting if the leaf is kept too wet. Certain species, *e.g., S. rexi,* will produce young plants from adventitious leaves that appear from near-surface roots. These, when reaching a size suitable to handle, may be detached and potted up.

Starting from Seed

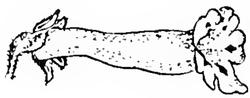
Finally, and by far the most satisfying method, is to grow from seed. It has been found that a good soil mix consists of 2 parts loam, 2 of coarse sand and 1½ of peat. As streptocarpus seed is one of the finest known (some 1 3/4 million seeds to

Streptocarpus rexi is a distinctive plant with a rosette of velvety leaves and large lavender flowers.

Hull

the ounce), care in sowing is important. The following method may be used to advantage.

Having prepared the soil, place the container to be used in a receptacle containing water. When the soil mixture is thoroughly saturated, sow the seed, preferably by placing it on the palm of the hand and gently brushing it off with a finger. This must, of course, be carried out in wind-free surroundings. The seed should not be covered as it will have adhered to the damp soil. Replace the container into the water. At all times, water should be about half an inch up the side of the seed pan. Humidity should be stimulated if possible and, as with cuttings, bell glass or greenhouse conditions aid germination. After the pan has been in the water for some 6 weeks, a green growth will appear, giving the appearance of a crust on the surface. Shortly after, tiny leaves of the young streptocarpus plants will show. At this stage, prick out by using a pen knife and repot in a mixture similar to that used for germination. Once potted up, the young plants should be well watered and shaded but at no time should they be saturated, as this condition may cause leaf-rot. ◆



PLANT HUNTING

(*Continued from page* 44)

press. A small notebook should be carried along in which collection number, date, location, identification (if known) and pertinent remarks on flower color, height and form of plant, type of environment, etc., can be recorded. Be sure to collect plants having blossoms, as these are often crucial to identification. If possible, press a couple of extra blossoms for closer study. Inspect the plants and change the newspaper separators every few days until the plants in your press have dried sufficiently to avoid the danger of mildew, being sure, of course, to preserve the identifying note with each plant.

In regard to mounting your specimens after your return home, if you present them to an institution they will generally prefer to have their own staff do it. However, if you wish to preserve them yourself, use a stiff white sheet of index paper, about 12 by 17 inches, the size of a standard herbarium mount. Neatly label each sheet, imitating the format you saw in the herbarium. Special mounting materials are available, again from natural science supply distributors.

The Amateur's Contribution

Amateur plant hunters can do a considerable service for the field of botany in these days of tight budgets in natural science institutions and the roster of professional botanists so small when compared with the job to be done. The serious amateur with vacation time at his disposal, with the ease and swiftness of modern travel, with personal funds budgeted for the purpose and, most importantly, with proper preparation and realistic goals, can make a significant, even though small, contribution. With adequate planning, two weeks in a given region can be quite productive in terms of confirming older botanical collections, pinpointing locations, checking geographical limits of distribution, collecting fresh specimens for modern study, introducing desirable plants and new strains into cultivation, bringing particular subjects to the attention of specialists, and a host of other possibilities. Beyond these, for the amateur with a thorough background and sharp eyes lies the intriguing though extremely rare possibility of discovering a new species.

As an avid amateur I can attest to the truth in David Fairchild's words—if one wants to badly enough, he will scrape his pennies together and somehow find a way to travel beyond the temperate world and into the tropics where he can experience at first hand the joy of being in the middle of that botanical three-ring circus where there is so much to see and do. ◆

FLORIST GLOXINIAS AND THEIR KIN

Sinningia and Rechsteineria provide the indoor gardener with many colorful species and hybrids

Carl D. Clayberg

NEXT to the African-violet, the best known gesneriad is the one that is commonly called "gloxinia" *(Sinningia speciosa)*. There is also a genus *Gloxinia*, but its species are scarcely known in cultivation. To distinguish the two, the popular indoor plant is designated today as the "florist gloxinia."

This lovely ornamental with its large inverted bell-shaped flowers above a low rosette of velvety leaves was introduced into Europe from Brazil early in the nineteenth century. Brazil is also the homeland of the some 20 other species in the genus *Sinningia*. A closely related genus, *Rechsteineria*, has about 80 species found throughout South and Central America. Species of *Sinningia* and *Rechsteineria* are unusual among gesneriads in possessing tubers which allow them to remain dormant during the dry season in their natural habitat.

The two genera are distinguished from each other mainly on the basis of flower shape and color. The flowers of *Sinningia* species are white or purple—rarely rose-red—and the corolla tube is usually funnel-shaped or pouched, or else the corolla margin is broad and flaring. *Rechsteineria* flowers, in contrast, are tubular and colored scarlet, orange or yellow.

The descriptions that follow are based upon a collection of species maintained at The Connecticut Agricultural Experiment Station, New Haven.* Some of the species have been introduced to this country so recently that they are not yet generally available through commercial growers.

Clayberg

One of the outstanding relatives of the florist gloxinia is *Sinningia discolor*. The flowers are bluish purple.

Sinningia

The *Sinningia* species are a varied group and few of them resemble the florist gloxinia. Two that do are *S. regina* and *S. discolor*.

Sinningia regina has dark purple flowers with a slender corolla tube and a slightly flaring margin. The leaves are dark green with light veins above and magenta below. *Sinningia discolor* has

* These species have been given to me by private collectors, botanical gardens, and several colleagues who have collected plants during recent trips to Brazil. To all of these sources I am indebted for their assistance.

Arnold

Sinningia eumorpha is one of the most popular of the florist gloxinia's relatives. Its white flowers are sometimes tinged with purple.

flowers of medium blue-purple with a broad tube and leaves similar to those of the florist gloxinia except for their longer petioles.

Two species, *S. pusilla* and *S. concinna*, are miniatures that grow no larger than about 2 inches high by 2 inches across. Both flower continuously throughout the year and never seem to need a rest. When a plant becomes too bushy, the foliage can be removed and the tuber will sprout again immediately if it is not allowed to dry out. The flowers of *S. pusilla* are a light purple color with a white throat, while those of *S. concinna* have dark purple lobes and a white throat spotted within in dark purple. Because both of these species require high humidity for best growth, they are ideally suited to culture in terrariums, bottle gardens, or other closed containers. Also, they grow particularly well under fluorescent lights.

Sinningia hirsuta, a species related to these two, was only recently brought to the United States. Although similar in habit, it has leaves about 4 - 6 inches long which are thickly covered with long, erect hairs. The flowers, scarcely larger than those of the other two species, have broad, white corolla lobes and a white throat spotted and shaded within in dark purple.

The remaining four species in cultivation have little in common. *Sinningia schiffneri* is the only completely nontuberous sinningia or rechsteineria. Because of this, it has been placed by one authority in a separate genus, *Paliavana*. The lack of tuber means that this species has no dormant period. The erect fleshy stems grow to an indefinite height, regularly shedding their lower leaves. To prevent plants from becoming ungainly, stem tip cuttings can be taken regularly. These root readily in a week or two. The small white flowers, lightly dotted within in magenta, are borne inconspicuously in the leaf axils. The apple-green, velvety leaves are quite attractive.

Sinningia barbata is a shrubby species that grows about two feet tall. As it has only a rudimentary tuber, it is best grown without a dormancy period. The large leaves are glossy, dark green above and magenta below. Lower ones are continuously dropping off, so that the plant should occasionally be started anew from tip cuttings. The greenish-white flowers are strongly pouched and hairy on the outside.

One of the most popular species is *S. eumorpha*. Its white flowers, sometimes tinged with purple, are profusely borne well above the glossy green, ovate leaves for much of the summer. This species has been of considerable value to the plant hybridizer because it crosses with most of the low-growing rechsteinerias. Another that hybridizes readily with rechsteinerias (the tall ones) is *S. tubiflora*. Although it is difficult to flower, the effort is worth while. The long, tubular, white flowers, which are borne at the tip of a leafless stalk 1 - 2 feet above the compact foliage, are highly fragrant.

Rechsteineria

The *Rechsteineria* species may be divided into two general groups. One group has broad, heart-shaped leaves and is usually relatively low-growing, 1 - 3 feet high. The other has elliptical leaves and is usually 3 to 5 feet tall. Both groups are further subdivided into species with corolla lobes of about equal size and species with the upper two lobes united and elongated to form a hood.

The best known and most attractive *Rechsteineria* is *R. cardinalis*. This low-growing species with velvety, heart-shaped leaves is usually summer-flowering, as are most other rechsteinerias. It is not difficult, however, to have its brilliant scarlet flowers produced at Christmas-time, when they are as appropriate to the season as the poinsettia.

Three other species in cultivation are allied to *R. cardinalis* and likewise have scarlet, hooded flowers. *Rechsteineria magnifica* is a little taller, 1 to 2 feet high, has larger leaves, and the flowers are borne in a cluster above the foliage.

Although similar to *R. cardinalis*, *R. cooperi* has a corolla tube that flares attractively at the throat and the margin is heavily marked within in deep purple.

R. macrorrhiza, as its name indicates, forms very large tubers. It is easily distinguished from the other three species by its small flowers (a little over an inch long) borne in a terminal many-flowered inflorescence on a plant 3 to 4 feet high.

The low-growing rechsteinerias with equal-sized corolla lobes are a varied and interesting group. Most of these have slender, tubular blossoms 1 to 2 inches long of orange or orange-red. A striking exception to this is *R. verticillata*, which has flowers of shell-pink heavily spotted in dark maroon and borne in a terminal umbel. Its dark green, glossy leaves are arranged in one or two six-leaved whorls towards the center of a three-foot stem. In young plants there are five or six pairs of opposite leaves.

Rechsteineria cyclophylla and *R. lineata* are two similar species, differing in the dark reddish-purple lines on the stems and petioles of the latter.

The white-woolly stems, leaves and

Rechsteineria verticillata has both leaves and flowers in whorls. The slender blossoms are shell pink, spotted with maroon.
Schulz

Arnold
Sinningia tubiflora, whose flowers are highly fragrant, is often used in hybridizing. Both leaves and long-tubed blossoms occur in pairs.

flowers of *R. leucotricha* are very decorative. In this group the flowers are often borne before the leaves are produced or when they are only partly developed.

The tall-growing rechsteinerias, because of their height, are not particularly suited to culture as house-plants. For those who have greenhouse space for them during their early growth period, however, they make spectacular specimen plants outside in the summer in a large pot or tub in the partial shade of a house or tree. Few of these species are available.

Rechsteineria sellovi has flowers with a pinkish corolla tube about 1½ inches long and equal-sized corolla lobes of cherry red borne toward the top of a 5-foot stem. Several feet shorter, *R. aggregata* has a corolla tube of similar shape an inch long and of a yellow color dotted in orange. Its leaves have a strong odor. Plants of *R. warszewiczi* are similar to *R. sellovi*, but bear hooded flowers of orange shading to yellow in the throat.

Rechsteineria allagophylla seems to be allied with the other tall species. Its leaves and flowers occur in whorls of three along a stem 1 to 3 feet high. The corolla tube is distinctive because it is about ½ inch long and thus scarcely extends past the enveloping calyx.

Rechsteineria tuberosa possesses characteristics of both the tall and low-growing rechsteinerias previously described, but does not appear to belong to either group. The plant is short, in fact it has no stem whatever. One or two broad leaves, up to a foot long, arise directly from the tuber. Their texture resembles that of chrysothemis leaves. The flower cluster also develops directly from the tuber and is leafless. The corolla is red with a yellow throat and has a margin of equal-sized lobes, the uppermost two of which protrude forward.

Rechsteineria tuberosa is a stemless plant with only one or two 12-inch leaves arising from the tuber. The flowers are red with a yellow throat.
Clayberg

Gloxinera

The close relationship between *Sinningia* and *Rechsteineria* is clearly indicated by the fact that hybrids, known as × *Gloxinera*, can readily be produced between species of the two genera. Until recently the gloxineras developed in this country have practically all had *S. eumorpha* as one parent and one of the low-growing *Rechsteineria* species as the other. There have been numerous such hybrids named and sold. They include 'Bernice', 'Clarice T', 'Edith M', 'Harold', 'Hopewell', 'Margaret Heald', and 'Rosebells' among others.

In the last few years a number of miniature and semi-miniature hybrids have become available. Some are crosses of two *Sinningia* species and will be described in the next section. These and the miniature gloxineras have one or both of the miniature species, *S. pusilla* and *S. concinna,* as parents. In a study of inter- and intrageneric hybridization conducted with *Sinningia* and *Rechsteineria,* I learned that *S. pusilla* will cross directly with *S. concinna, S. eumorpha, S. schiffneri, R. leucotricha* and *R. lineata.* All except the first of these hybrid combinations are completely sterile, because their chromosomes fail to pair in meiosis. Sterility of this type normally can be overcome by using the alkaloid colchicine to induce tetraploid forms of such hybrids so that each chromosome has a homologous pairing partner. When this was done with the hybrid *S. pusilla* × *R. leucotricha,* the tetraploid proved to be completely fertile and was released in 1965 under the name 'Pink Petite'. Although *S. pusilla* will not cross directly with *R. cardinalis,* the cross can be made with hybrids of the latter species. Tetra-

Clayberg

'Bright Eyes', one of the author's own crosses, is a second generation hybrid of *Sinningia concinna* × *S. pusilla.*

ploids derived from the combination *S. pusilla* × (*S. eumorpha* × *R. cardinalis*) were developed and released in 1964 as the 'Connecticut Hybrids'. These tetraploid gloxinera hybrids, as well as the hybrid sinningia tetraploids, all tend to have brittle foliage and be slow growing. Because of the latter characteristic, young seedlings should not be overfertilized nor grown in a soil mix too rich in nitrogen. The tetraploids do have larger flowers, but the principal reason for inducing tetraploidy is to restore fertility so that the hybrids can be propagated from seed. It may be possible for the breeder to overcome the slow growth and brittle foliage of these hybrids.

Additional gloxinera hybrids have been obtained by crossing *S. tubiflora* with the tall *Rechsteineria* species: *R. aggregata*, *R. sellovi*, and *R. warszewiczi*. These hybrids are mostly too tall to be of much value as ornamentals. In addition they tend to have few and infrequent flowers, like *S. tubiflora*. Their chief advantage appears to be in the transfer of genetic traits from their parents into other species. Among the most valuable characteristics of the parental species are strong floral fragrance in *S. tubiflora* and yellow flower color in *R. warszewiczi*. I am presently working to transfer these traits into more attractive material.

Intrageneric Hybrids

The sinningia hybrids of greatest horticultural value thus far have been the miniature and semi-miniature ones having *S. pusilla* or *S. concinna* in their parentage. The first of these was my cross of *S. pusilla* × *S. eumorpha*. As the original diploid hybrid was sterile, a fertile tetraploid was released with the name *Sinningia* × *pumila* 'Tetra'. A superior sterile diploid seedling, made by repeating the original cross with slightly different parents, was developed by Ruth Katzenberger and named 'Dollbaby'. A spontaneous tetraploid of 'Dollbaby' is now generally available. *S. concinna* and *S. pusilla* can be intercrossed reciprocally to give weakly fertile hybrids. The first generation (F_1) hybrid has been produced and offered for sale by Lyndon Lyon under the name 'Wood Nymph'. I have bred and released an attractive and vigorous second generation seedling of this cross named 'Bright Eyes'.

Many interspecific hybrids have been obtained in rechsteineria as part of my hybridization studies of this genus, but very few offer anything superior to the species themselves. Perhaps the best of these combinations is the cross *R. cardinalis* × *R. leucotricha*. In contrast to most of the other interspecific hybrids, this one has smaller leaves than either of its parents. Another desirable feature of the hybrid is its white-woolly foliage inherited from *R. leucotricha*. ◆

For culture of the florist gloxinias and their kin, see page 69.

'Bernice' is one of several hybrids between *Sinningia* and *Rechsteineria* that have been given the hybrid generic name of *Gloxinera*.

Arnold

GESNERIADS AS A FAMILY

Two thousand species have so far been discovered, 300 of which are in cultivation

B. L. Burtt

THE diversity of gesneriads is such that there is no simple non-technical prescription for their recognition. I once tried to explain the family to someone I met on a collecting trip in Malaya. Could there be a common factor to link the blue saintpaulia-like *Boea* of exposed limestone cliffs, the red trailing *Aeschynanthus* high up in the rain forest, the yellow-flowered *Didymocarpus malayanus,* called the Malay primrose, on the forest floor below, and the bizarre single-leaved *Monophyllaea*? This by no means exhausted the range in one small area. The vastly wider sweep of a world view, or of a well-stocked botanic garden, must encompass the flaming dragon-flowered columneas, the tuberous-rooted rechsteinerias, the lovely wild velvet-slipper which has come to be known as the "florist gloxinia" *(Sinningia speciosa*—so disimproved by man's efforts) all from tropical America, the prized wool-wrapped bundles of *Jankaea heldreichi* from classical Mount Olympus and sturdy rosettes and golden flowers of *Briggsia aurantiaca* from 15,000 feet on the Tibetan mountains. I mention few out of many worthy of mention. Why do we regard this diverse conglomeration as a family, as an interrelated group?

That is the question that this article aims to explore.

2,000 Species

First, a word about the size of the family *Gesneriaceae* as we now know it. This is important because, as it is easy to appreciate, the larger a group the greater the likelihood of there being exceptions to any general statements made about it. The *Gesneriaceae* are not one of the great families of flowering plants, but they contain perhaps 125 genera and something over 2,000 species—one species, that is, for each word allotted to this article. These are figures which entitle it to be ranked among the medium-large families. Perhaps some 300 species are currently in cultivation.

Family History

The first gesneriad to become known to botanists was, not unnaturally, that solitary one found in western Europe: *Ramonda myconi,* a plant of rocky places and mountain cliffs in northern Spain and the Pyrenees. It makes its bow in the "Historia Generalis Plantarum" of Jacques Dalechamps published in 1587, and was there called *Auricula ursi myconi.* Dalechamps records that it had been called *Auricula ursi* by Myconus (Franciscus Myconus or Mycó, a doctor of Ausonia, which is now Vich, north of Barcelona), but that it was different from the other auriculas. It was in cultivation in the Low Countries in 1604. In 1753 Linnaeus classified it as *Verbascum myconi.* This may seem strange if you think of *Verbascum* (mullein) as a tall yellow-flowered plant with great flannelly leaves; but there are species like *V. phoenicea* which are only a foot or so high and have purple flowers. If Linnaeus had used a compound microscope he might have noted one point which would have confirmed him in the idea that this was a *Verbascum*: the hair-patches at the mouth of the corolla are formed of club-shaped hairs of a single cell whose walls are covered with minute protuberances: the hairs on the filaments of *Verbascum* are very similar. The occurrence of just

Arnold

The trailing branches of *Aeschynanthus marmoratus* are typical of the numerous species in this Asiatic genus. In America this habit is seen in *Codonanthe, Nematanthus, Hypocyrta* and other New World genera.

this sort of hair is not too common and it is interesting to find it both in the true *Verbascum* of the figwort family (*Scrophulariaceae*) and in this false one that we now call *Ramonda,* a name given to it in 1780.

The illustration published by Dalechamps shows one of the features that is characteristic not only of *Ramonda* but of nearly all the *Gesneriaceae* of the Old World: this is the twinned flowers. These can be well seen in any African-violet: at each division of the inflorescence two flowers are produced in the fork; nearly all other plants with flowers in cymes produce the flowers singly. Apart from the Old World *Gesneriaceae,* and just a few of those in the New World, one genus that has twinned flowers as a constant feature is *Calceolaria* of the *Scrophulariaceae;* this shows another link between the two families.

After *Ramonda* it was the New World *Gesneriaceae* that next became known. Charles Plumier (1703), who was ever eager to commemorate earlier botanists even if they had no connection with the plants he was naming, described four genera: *Gesneria, Columnea, Bellonia* and *Besleria.* These names were all retained by Linnaeus (1753) and are still in use today. In 1756 Patrick Browne introduced the now familiar name *Achimenes* for two plants from Jamaica.

In mentioning these first known gesneriads I am picking them out with hindsight. At the time they were first described they were not linked together in any way. In the late 1750's and 1760's the idea of the plant family as we know it today was developing fast, especially in Paris in the work of Michel Adanson and of the brilliant family of de Jussieu; nevertheless many years were to go by before anything resembling the modern family *Gesneriaceae* crystallized from the growing knowledge of the plants themselves. Adanson (1763) referred the genera *Gesneria* and *Bellonia* to *Caprifoliaceae; Achimenes, Columnea* and *Besleria* to *Scrophulariaceae;* Antoine Laurent de Jussieu (1789) placed *Achimenes* and *Boea* (now first described) in Scrophulariaceae; *Columnea, Besleria* and *Cyrtandra* were genera allied to that family; *Verbascum* (including *Ramonda myconi*) was in Solanaceae, *Bellonia* in Rubiaceae and *Gesneria* in Campanulaceae. Clearly, one factor that made it difficult for these early botanists to get the rudiments of the Gesneriaceae together was the presence of an inferior ovary in *Gesneria* and *Bellonia.*

The first real anticipation of the modern Gesneriaceae is found in a memoir by A. L. de Jussieu in 1804: he quotes a French colleague, A. Richard, for the view that certain genera—including *Gesneria, Besleria, Columnea, Achimenes, Gloxinia* and, perhaps, *Cyrtandra*—should form a separate family. At this time Asiatic gesneriads were still virtually unknown and the few discovered had been quietly accommodated in existing genera of other families—*Agalmyla* had been placed in *Justicia* (*Acanthaceae*) by Lamarck, *Chirita* and *Aeschynanthus* in *Incarvillaea* (*Bignoniaceae*) by Roxburgh—and they did not yet form part of the problem.

New Species from Asia

Soon, however, the flood-gates of Asia began to leak: Wallich and Buchanan Hamilton were making rich collections in India; David Jack was penetrating Malaysia with Sir Stamford Raffles, founder of Singapore. In January 1822 David Don read a paper to the Wernerian Society in Edinburgh establishing the family Didymocarpaceae, which did not include *Cyrtandra*: in May of the same year Jack had one read to the Linnean Society of London establishing the family Cyrtandraceae, which did include *Didymocarpus.*

It was David Jack who named *Aeschynanthus,* and this is now known to be a very large genus of forest plants, chiefly epiphytes, though some sprawl over rocks, and it ranges from the Himalayas, southern India and Ceylon to the Solomon Islands. The brilliant red or orange flowers are well known in cultivation, for the various species make attractive basket plants in the greenhouse and even grow quite well as house plants. In the more natural surroundings of a landscaped hothouse they will romp happily over artificial moss-covered "trees" and produce a veritable blaze of flowers. These often need to be cross-pollinated by hand if they are to set fruit, because in each individual flower the stamens protrude and ripen first and then bend over and make way for the elongating style and stigma. They are thought to be pollinated in nature by birds, but precise observations are lacking.

The fruit of *Aeschynanthus* is noteworthy, for it is a narrow pendulous pod a foot or so long from which are released a vast number of minute seeds, with a long fine hair at one end; at the other end there may be either one hair, or two, or a whole tuft of hairs. It is not difficult to see that these fine hairs help the seeds to be wafted gently along in the forest and then to be caught by any hospitable rough or mossy bough they touch.

African Discoveries

It was in the early 1820's that the Kew collector Bowie found the first African gesneriad: we know this as *Streptocarpus rexi* and it is one of the most widely cultivated species. There are now another hundred in the same genus, some of them very lovely plants. It was the first species of *Streptocarpus* that drew attention to one of the most peculiar features of the Old World members of Gesneriaceae: this is that after germination one of the cotyledons enlarges while the other does not. It is most obvious in species such as *S. polyanthus, S. saundersiae, S. grandis, S. dunni* in which the one cotyledon enlarges to become the first, sometimes the only, fully developed leaf of the plant, and the inflorescences arise at its base. It was soon shown, however, that the first leaf of the rosette of *S. rexi* and of the caulescent species like *S. holsti* and *S. caulescens* are cotyledons. It is now known that these curious seedlings are found in *Aeschynanthus, Saintpaulia, Didymocarpus, Boea, Chirita*—in fact, in almost all the Old World gesneriads. In the New World plants the seedlings are normal. The true exceptions to this geographical pattern are quite simple. A few species of the tropical Asian genus *Rhynchoglossum* are found in Central America; a few southern genera in the Old World, including *Rhabdothamnus* and *Fieldia,* do not show enlarged cotyledons, but their affinity is with *Mitraria* and *Sarmienta* in South America—a well known type of geographical link.

Significance of Geography

Now it is one of the fascinating features of Gesneriaceae that this geographical cleavage between the plants of the Old World and those the New does really seem to be of major taxonomic importance. Nice confirmatory evidence has recently come from Dr. J. B. Harborne who has been studying the chemistry of the pigments. A rare type of anthocyanin—one that gives vivid red coloring—is characteristic of many of the

Graf

Graf

Streptocarpus rexi, known since the 1820's, was the first African gesneriad to be discovered. A hundred more, of highly varied character, have been discovered since then in this genus alone, among them such single-leaved species as at right.

New World members, while certain interesting yellow pigments have been found only among species from the Old World. Not all the species can be diagnosed in this way, but so far there are none which positively transgress the apparent pattern.

There are a number of other features that can be brought into consideration (the shape of the placentae on which the ovules are borne, inflorescence, pollen type and chromosome number) : none of them are diagnostic but all tend to fall into line with the idea that the major subdivision of Gesneriaceae should be into two subfamilies—*Gesnerioideae* with equal cotyledons (New World) and *Cyrtandroideae* with unequal cotydelons (Old World).

In exploring the subdivisions of the family, the rather tenuous nature of the characters employed must surely carry the implication that at a higher rank—that is, at the level of the family itself—these plants must all be grouped together.

Need for Further Knowledge

The inquiring plantsman who becomes a gesneriad enthusiast will quickly come to realize that scientific knowledge of this group is remarkably deficient. We are only just beginning to understand some of the complicated patterns of growth associated with the anomalous species of the *Cyrtandroideae.* The capacity of this family for vegetative reproduction from leaf-cuttings is well known to the horticulturist. Does it occur in nature? In Sarawak I found a very interesting *Cyrtandra* (as yet unnamed) growing on a bank above a forest stream; a leaf had been broken off and had evidently been flattened onto the bare clay bank below by rain. The leaf was torn and at several places along the broken edges tiny plantlets were regenerating, just as one would be so pleased to see them doing in the propagating house.

There are enough puzzles in the Gesneriaceae to keep botanists happy for many a long day; there are enough undescribed species, too, for these plants are so local in their distributions that almost every new area visited may, in the regions where they are most numerous, produce a novelty. Growers who obtain seed direct from the wild should therefore make a point of finding out and recording its precise origin. They can thus give valuable help to the taxonomist—and in doing so greatly increase the interest of their hobby. ◆

THE LITTLE ONES

Miniature gardens in limited indoor areas are possible with tiny gesneriads

Ruth Katzenberger

Katzenberger

'Dollbaby,' one of the author's own miniature hybrids

ANYONE with enough space for a brandy snifter need not deny himself joys of having flowering plants indoors. This is all that is needed to grow a specimen of *Sinningia pusilla,* which is a tiny gesneriad of great charm.

The search for good window-sill-size plants has created a special interest in the spectacular gesneriad family. Many genera of the *Gesneriaceae* have miniature species, and these have been widely used in hybridizing programs by both amateur and commercial people. Notable among the results is *Sinningia* 'Dollbaby'.[1]

Culture of the little ones is much the same as for the larger members of the family. The slightly greater humidity requirement is easily met by keeping them in a Wardian case, or terrarium, which can be any type of transparent enclosed container for growing plants. It may be small or large, contain one plant or many. Plants may be maintained in separate pots or planted directly into the container to make a miniature landscape. While they can be grown without protection, they do best when enclosed. A Wardian case protects the plants against the destructive gases and dust of our air-polluted cities. By holding the moisture, as in a diminutive rain forest, it requires a minimum amount of care.

It is important to understand that all terrarium plantings have a limited life span, even though it be long. It is dependent upon the plant material and the size of the container used.

There are several ways to make a Wardian case to your particular dimensions. For use in a dark corner, it may be fitted with fluorescent lights.

Method A. Make a box from 2 to 4 inches deep for the bottom and line it with plastic. A painter's drop-cloth[2] used double thickness works well. Have four pieces of glass cut at least 12 inches high to fit the four sides and a fifth cut to fit the top. Tape together the four sides, using either adhesive or electrician's plastic tape. Place the taped sides to fit into the bottom. Bind the four edges of the top with tape and put it in position after the plants are in.

Method B. If you are handy with a hammer and saw, construct a wooden frame as shown in the drawing. The clear sides and top may be of glass, plastic or plexiglass.

Materials available today permit such vast possibilities that anyone, anywhere, can have plants in the house. The only necessities for a plant enclosure are: clear viewing, a covering, and sufficient

[1] This is the author's own cross between the tiny *Sinningia pusilla* with lilac flowers and the large white-flowered *S. eumorpha.* The hybrid is a miniature plant with lilac flowers.

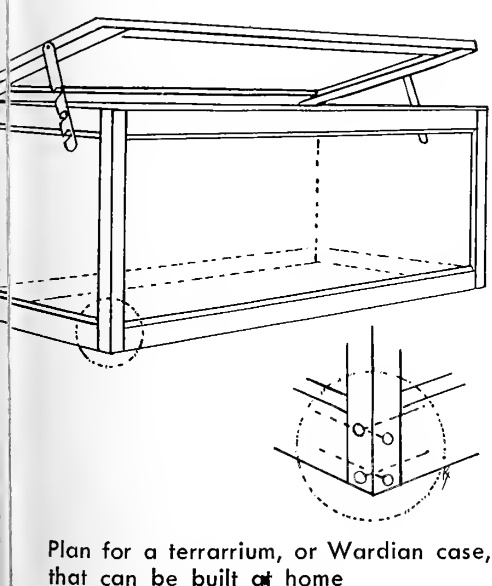
[2] Easily obtained in any hardware, paint or dime store for 29 cents and up.

One of the smallest of the miniature gesneriads is *Phinaea multiflora,* shown here natural size, the entire plant being barely half an inch tall.

Alfred Katzenberger photos

A potful of *Streptocarpus rimicola* in full flower

room for the plants, besides water, light, fertilizer and tender loving care. Any wide-mouthed jar can be used. Other easily obtained glass containers are apothecary jars, brandy snifters, candy jars, fish tanks. Plastic shoe and sweater boxes make good terrariums. Minute plastic greenhouses that will fit on a window-sill can be purchased.



Plan for a terrarrium, or Wardian case, that can be built at home

Begin the terrarium with a 1-inch layer of gravel and horticultural charcoal. Next pack in a sterile growing medium such as is recommended for gesneriads. This should be moist but not wet. The layer of growing medium need not be deep: from 1 to 3 inches depending upon the size of the container and the plants to be used.

Be sure to keep the sides clean during these operations because they cannot be washed down later. If necessary, brush clean with a small paint brush. By using rocks or driftwood, the growing medium can be arranged in hills and valleys to simulate an uneven terrain.

Place the chosen plant material in position, allowing enough space for further growth. To hide the growing medium between plants, cover with dampened sheet moss. If you have used damp materials it should not now be necessary to water the completed landscape, but if you must water, use an atomizer sparingly.

The growing plants and temperature changes will cause the moisture to condense on the sides and top. For clearer

MINIATURES FOR A TERRARIUM

Genus	Species or Hybrid	Description			
		Size[1]	Roots	Flowers	Foliage
Diastema	*maculata*	3 × 2½	rhizome	purple	dark green quilted
	quinquevulnerum	4 × 6		white with dark spots	bright green
	rupestre			white	pale green
	vexans			white with dark spots	medium green, white hairs
Didymocarpus	*vestitus*	3 × 6	fibrous	clear lilac	pale green, white hairs
Gesneria	*pumila*	2 × 2	fibrous	white	dark green, lanceolate
Gloxinera	Connecticut Hybrids	1 × 4	tuberous	mod. purple dark spot in throat	dark green with red undersides
	'Cupid's Doll'	1 × 5		mod. purple deeper throat	medium green, prominent red veins, white hairs
	'Pink Petite'	1 × 2		pink	pale green, very hairy, tiny
	'Ramadeva'	1 × 3½		pink with violet throat	
Kohleria	*amabilis*	6 × 6	rhizome	pink and white spotted	pale green, dark veining
	lindeniana	6 × 6		blue and white	bronzed green, silver veining
Koellikeria	*erinoides*	2 × 6	rhizome	white and pink	medium green with silver spots, soft hairs
Phinaea	*multiflora*	1 × 2½	rhizome	white	pale green, white veins, tiny
Saintpaulia[2]	*shumensis*	2 × 4	fibrous	white with blue eye	medium green, red undersides
Sinningia	'Bright Eyes'	1 × 2	tuberous	med. purple clear white throat	medium green, red veins and undersides, tiny
	concinna			dark purple spotted white throat	medium green, red veins. tiny
	'Dollbaby'	2 × 6		lilac and white	medium green, sometimes red undersides
	pusilla	½ × 1		lilac and white	medium green, red veins, tiny
	'White Sprite'			white sport of *S. pusilla*, greenish yellow throat	
	'Wood Nymph'	1 × 2		purple with spotted throat	
Streptocarpus	*cyanandrus*	2 × 8	fibrous	blue with dark blue lines	one, possibly more leaves lanceolate
	kirki	6 × 4		purple	pale green, heart-shaped
	rimicola	1½ × 3		white	medium green, single leaf

[1] Size is measured in inches. Height exclusive of inflorescence and pot × diameter.
[2] Saintpaulia miniature hybrids are too numerous to mention. See the catalogs of commercial growers.
The alpines have not been mentioned because of different cultural requirements. There are other small gesneriads not mentioned here because of unavailability and sometimes a lack of known descriptions.

viewing, also for air circulation to prevent mildew and rot, open the top a little occasionally. Test the soil periodically with a finger to determine when it is necessary to add water. Do this only with an atomizer. Overwatering is the most common failure in terrariums.

If clean plants are placed in a sterile

growing medium there should be no pest problem. An occasional squirt from an African-violet insecticide bomb insures their remaining clean. Close down the lid to keep the spray inside for greater effectiveness.

Miniature gesneriads make exciting displays. Porous limestone rock or feather rock can be used for arrangements by making pockets in the rock and filling these with the growing medium. The tiny sinningias and gloxineras can be planted in these holes. Small logs of fenrbark can be used in a similar way. These living arrangements, which simulate the epiphytic growing conditions of the plants, can be kept in good condition if given adequate light and humidity. ♦

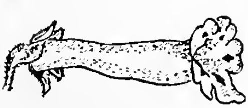
Buhle

Sinningia pusilla grown at home by Sarah Hyde Douglas of the Brooklyn Botanic Garden staff. For her hobby of raising miniatures, Mrs. Douglas uses clear plastic containers illuminated with fluorescent tubes about 6 inches above.

GESNERIADS FOR BONSAI-TYPE CULTURE

There are a few gesneriads that lend themselves to being underpotted or grown in bonsai-type curture. Those that are listed in the following chart can easily be kept quite small by crowding the roots and by proper pinching and pruning.

Genus	Species	Description		
		Roots	Flowers	Foliage
Achimenes	*erecta*	rhizome	red	tiny medium green with red veins
Boea	*hygroscopica*	fibrous	purple	pale green quilted with white hairs
Episcia	*dianthiflora*	fibrous	fringed white	small dark green, thick
Gesneria	*acaulis*	fibrous	red	pale green, lanceolate
	christi, 2 variants		red, red with black mouth	
	citrina		yellow	dark green, small
	cuneifolia, 3 variants		red, flared mouth, yellow	pale green, lanceolate
	pauciflora		orange	
Hypocyrta	*nummularia*	fibrous	red	medium green, small
	wettsteini		orange	dark green, waxy
Streptocarpus	*saxorum*	fibrous	lilac	pale green, softly hairy, thick, elliptic, small



GROWING AND SHOWING

Specimen gesneriads worthy of competition give the grower an exciting challenge

Olive S. Hull and William Henry Hull, Jr.

THE true joy of *growing* is the pleasure of living amidst the year-round beauty of decorative plants. *Showing* provides the continuing incentive and inspiration so essential for improvement.

GROWING

There are many ways of growing gesneriads. In city apartments they may do best under fluorescent lights. Most of ours grow under lights in the basement. Others stay in front of our south, east and west windows where the light is indirect because of a wide overhang. A few bask in our small greenhouse.

A focal area in our living room is a plant stand, a small streptocarpus at the top. Below the shelf of African-violets is *Streptocarpus saxorum*, which receives full sun by means of its winter placement in front of the lowest portion of a south window wall. The overhang protects the other plants from too much light. (See page 2.—ED.)

We are especially partial to gloxinias, both species and hybrids, their resplendent colors are so spectacular. Undoubtedly your own first gloxinia will be of the bell or florist type, such as *Sinningia speciosa* 'Fyfiana'.

As your next one, why not try a slipper type, such as *Sinningia speciosa maxima?* The plant illustrated here, an unnamed hybrid, was the best of a hundred seedlings that we grew. Therefore we singled it out for propagation. This process of selection is a crucially important factor in growing for showing. Meticulously and ruthlessly, we eliminate the tubers of all but exceptional plants.

The double-flowering sinningias are more difficult to grow well. Often their stems are too weak to support their heavy blooms. Tubers that give rise to such characteristics should be discarded, for the resulting plants will fail to be of specimen quality. 'Monte Cristo' is highly satisfactory. Its flowers are a glorious deep red.

Gloxinia Culture

It is simple to grow specimen gloxinias rather than mediocre ones. Briefly, this is our procedure:

1. Buy Good Tubers

Our original tubers were of named species or varieties, and were purchased from reliable plantsmen. We were therefore confident that they would be of superior quality. If, instead, we had bought unnamed tubers from a large bin at a roadside stand, we might have chosen either poor or good ones. The determining factor is not *always* size, even though the majority of large tubers are superior. Some small ones produce multi-flowered plants. Conversely, big tubers frequently are sparse bloomers. Unless these latter ones have unusual redeeming features, they should be thrown away. A scrupulous nurseryman does this.

2. Planting the Tubers

A 5-inch pot is standard for average tubers. A squatty, azalea-type container is best. The tuber should be placed concave side up. Provided that cultural treatment has been A-1, we replant them each following year in the next-sized pots. An 8-inch pot may eventually be required. A margin of 1¾ to 2 inches should be allowed around the tuber.

A layer of gravel and charcoal over the bottom of the pot assures good drainage

Hull

As yet an unnamed hybrid, this slipper type gloxinia *(Sinningia speciosa maxima)* was selected as the best among 100 seedlings grown by the authors.

and sweet soil. Dry African-violet soil and perlite, two to one ratio, plus 3/4 to a scant teaspoon of bonemeal per 5-inch pot, are thoroughly mixed and a portion is placed over the bottom layer. The tuber is then set in place and just enough of the mix is added to barely cover it. The soil is settled by tamping the pot. The final step is watering to the point of saturation. Now place the pot in a warm situation, ideally over bottom heat.

3. Intelligent Watering

In the beginning stages of growth, the right amount of water is extremely essential. Tepid water is applied to the surface, but *only* when the soil is dryish. In approximately three weeks, the first set of leaves should appear. As plants increase in size, and as buds form, we step up the watering in order to keep the potting medium evenly moist, but never soggy.

4. Fertilizing

It is time to start fertilizing when the leaves extend beyond the rim of the pot. We add fish or whale emulsion—¼ teaspoon diluted in the regular watering—every tenth day.

5. Care after Flowering

The flowers last about two months. After removing them, give your gloxinias optimum attention right through August. This is the period during which next year's blooms are forming.

6. Propagating the Prize-winners

It is important to recognize and save the plants worthy of propagating. We do this near the end of the flowering period, removing several small healthy center leaves, and treating each as follows:

a. Shorten the petiole to ½ to 1 inch, leaving it just long enough to stand upright in the soil mix. After dipping the petiole in a rooting hormone, plant it in a sterile 2-inch pot which has drainage and is filled with one-half each of African-violet soil and perlite or with a favorite rooting medium.

Hull

Episcia dianthiflora grown in a hanging basket. When stolons are constantly pinched back, the plant becomes more densely foliaged. If the removed stolons are placed on damp sphagnum moss and enclosed in a polyethylene bag, they develop rapidly into flowering plants.

b. Use a large tag. Record the identity of the leaf and the date of propagation. On the reverse side, add transplanting and cultural data.

c. Place the potted leaf in an inflated polyethylene bag (to simulate greenhouse humidity), in indirect light. Open the bag on the third day. Remove the plantlet from its bag in a week or so. Its roots now should be formed.

When the plant's leaves extend beyond the rim, it is ready for transferral from its 2½-inch pot to a 4-inch pot. When buds form, remove them to prevent loss of vigor for its potentiality as a show plant the ensuing year.

7. Dormancy

Toward the end of the summer the original mature plants are prepared for dormancy by gradually giving them less water. A few weeks later, we place them in a dark cool corner of our dry basement. When the foliage dies down, we remove it. Once monthly, we give the tubers a very small amount of water to prevent shrinkage. When regrowth commences, the time varying from one to three or even four months, the entire cycle is repeated; and this is a reoccurrence year after year.

SHOWING

To determine whether an individual plant is meritorious enough to show, we re-study the respective judging scales, in order to evaluate each prospective entry. Attention is given, too, to the numbers of points for the respective characteristics.

Which Plants Should be Exhibited?

In the preliminary judging of our own plants, here are the questions we ask ourselves:

1. Is the proportion between the plant and the container pleasing?
2. Is the foliage free from blemishes:
   a. Water-spotting (often caused by cold water or placement in sun when wet)
   b. Brown-burning (too near direct daylight)
   c. Mechanical damage (though not too serious a fault, it may be an indication of carelessness)
   d. Pest damage (aphids, mites, thrips, black vine weevils—owing to lack of preventive pesticidal applications)

Hull

Red flowers and velvety-textured leaves on *Rechsteineria cardinalis* make it a suitable plant for a holiday-season centerpiece.

c. Disease (fungi—phytophthora or pythium—easily forestalled through ample drainage, judicial watering, and use of sterile soil and pots)
3. Is the plant compact (as a result of accurate lighting)?
4. Is the pattern of both the foliage and bloom symmetrical?
5. How floriferious is it? (Bear in mind that buds count, too.)
6. Are the outer petals fresh?
7. Are the open flowers uniform in shape, size and colors?
8. Is the center of the flower open? (This applies to all round blossoms—particularly to gloxinias.)
9. Are the lowest florets of spikes (*Smithiantha*, etc.) or of clusters, (*Rechsteineria*, etc.) in good condition?
10. Do the spikes and clusters have as many open florets as possible?

Hull

Kohleria eriantha, which grows from a rhizome, is easily raised as a house plant. The flowers are orange-red; the bright green leaves are bordered with red hairs.

The Skill of Timing

Trying to rectify the timing of flowering plants so that they will be in their prime on the opening day of a show is the most stimulating and exacting phase of exhibiting. This is even more challenging when plants must bloom ahead of their natural season. Perhaps these hints may be helpful:

1. Keep a record each year of pertinent information: day and night temperatures, number of growing days for the genera being grown, number of sunny and of bleak days for daylight-grown plants, quantity and quality of leaves and flowers.
2. Try forcing if plants seem to be maturing too slowly by:
   a. Keeping the soil moist, using warmer water (avoid saturation).
   b. Raising the soil temperature (we use a heating cable).
   c. Increasing the air temperature.
   d. Feeding with superphosphate.
   e. Increasing the day length (window-sill or under-glass plants may be placed under fluorescents).
3. Retard others by:
   a. Withholding water as much as possible.
   b. Placing them in a cool, shaded area.

Preparing for the Show

1. Read and re-read the schedule in order to:
   a. Avoid disqualification (for example, often, a multi-crowned gloxinia is entered when the schedule specifies a single crown).
   b. Follow the rules (be certain to enter by the deadline, to arrive by the indicated time, etc.).
   c. Grow the *right* exhibit for the specified class. For example, does the schedule indicate whether a flowering plant with no blooms may be entered in a foliage division?
2. Groom fastidiously
   a. Eradicate spray or residue from the foliage.
   b. Remove (inconspicuously) faded flowers and unsightly leaves.
   c. Scrub pots immaculately spotless.
   d. Allow no dust to settle on the plants. Cover them lightly if they must be entered a day ahead of the show.
3. Label meaningfully
   a. Write labels well in advance with indelible pencil or pen.
   b. See to it that labels are legible (lettering at least ⅜ inch high).
   c. Use both scientific and common names.

Tuber Experiment

THAT tubers can produce a few flowers without benefit of soil can be shown by a simple experiment. This five-year-old X *Gloxinera*, which we had planted with optimum care annually, was intentionally left unpotted. The only care it received was its placement under fluorescent tubes, and misting twice daily. No fertilizer was applied. Notice that both the foliage and the flowers matured.

As a point of interest, we removed the growth, repotted this same tuber and gave it good cultural conditions. Its flowers were countless. Our conclusion is that valuable stock plus individual treatment is indispensable.

Hull

d. Add relevant facts—natural habitat, cultural data, etc.

Transporting Entries

Getting to the show without mishap is always an accomplishment. We have tried many devices, but now resort to these four:

1. Fit pots snugly into home-made redwood baskets of differing sizes.
2. Brace each with bricks on all sides.
3. Leave ample space between exhibits in order to prevent catastrophes. Damage may occur from shifting during sudden stops.
4. Protect blossoms and tender tropicals from wind and weather if the exhibits have to be carried out-of-doors. We find that a single piece of newspaper stapled loosely seems to be the least injurious to fragile flowers.

Early Arrival and Departure

Take pleasure in setting up the exhibit by following these two suggestions:

1. Allow plenty of time in order to avoid last-minute haste. Be prepared for the inevitable delays of parking, unloading, securing entry cards, getting the approval of the classification committee and finding classes. This will permit a precious dividend of leisure for the final inspection and for the exhilaration of being a small part in a big and beautiful show.
2. Depart serenely from the show floor long before judging commences.

When the flower show opens, enjoy it to the utmost! Congratulate the winners and exchange cultural ideas. Determine why *their* plants were superior. It is our feeling that, through such diagnosis, we have gained more knowledge by losing than by winning.

During dismantling, begin then to contemplate next year's exhibits; this is none too early. Throughout the bleak winter months, continue to *read* and to *evaluate* current available literature, interpreting it in the light of previous growing experiences. ◆

PROPAGATION OF GESNERIADS

Any of the numerous methods make increase of stock a simple matter

Frances N. Batcheller

GESNERIADS are among the easiest of plants to propagate. Suggestions are given here for increasing them from rhizomes, tubers, propagules, leaves, cuttings, offsets, stolons and seeds.

General Rules

The rooting medium should always be sterilized. Boiling water can be used for shallow layers. The medium can be of vermiculite, perlite, sphagnum moss or sand, or a combination of several of these ingredients. It should be porous enough to supply oxygen to the roots and maintain an even dampness at all times. Sogginess, however, should always be avoided. Yet the humidity must also be high, or the cutting will wilt. This is easily provided by a terrarium or plastic cover of some sort. Polyethylene may be the propagator's best friend, but beware of direct sunlight when it is used, or it can become a lethal steam bath.

Do not fertilize cuttings until roots have formed.

Practice propagation methods on easily replaceable material. Do not wait to try them out on a valuable specimen. Not everyone is equally successful with the same method. If material is either too woody or too young and tender, it may not root successfully.

Vegetative Methods

Scaly rhizomes are found at the base of the stem of a number of New World gesneriads. These may be very small in *Achimenes,* or quite large in *Kohleria.* These rhizomes should be separated from the old plant when it dries up at the end of the growing season. If the soil is allowed to dry out, the rhizomes are easier to remove from the roots. These rhizomes may be packed in vermiculite and stored in plastic bags or repotted to be ready for the next growth cycle. The rhizomes will shrivel if dried out too much, or rot if kept too damp. Small rhizomes can be planted four or five to a pot, large ones generally only one to a pot. The rhizomes should be planted horizontally, about one inch below soil level. Broken pieces of rhizomes, even single scales, will sprout and make new plants.

Rhizomes and also tubers (see directly below) can be sprouted in damp sphagnum moss and then potted up when a small amount of new growth has been made. This method is useful for rhizomes if it is important for the growing tip to be well centered in the pot.

Tubers are formed by a few gesneriads such as *Sinningia, Rechsteineria* and *Chrysothemis.* These tubers should be planted with the rounded side down. The indented top of the tuber should be covered with about one inch of soil. Roots grow from the top as well as the bottom of the tuber. Rechsteinerias have a tendency to push up above ground level as they grow.

Propagules, or above-ground reproductive parts, form on some gesneriads. *Chrysothemis* forms bulbils in the leaf axils. *Achimenes* and some of the other scaly-rhizomed plants may form waxy rhizomes on the flower stems or in the leaf axils. *Titanotrichum* forms long whip-like shoots bearing buds that resemble seeds. Any of these parts may be detached and used for propagation.

Leaves may be rooted in plastic boxes, plastic bags or small seed flats containing a layer of rooting medium. After dipping the end of the leaf-stalk, or petiole, in hormone and fungicide powders, insert it into the rooting medium. Large leaves

may root more easily without wilting if cut back to one-half or one-third their length in a V-shape. On tuberous species, new tubers may form at the base of the petiole, although no new growth may appear above ground before the old leaf dries up. This small tuber will sprout after a dormant period. Slitting the base of the petiole will frequently result in two tubers instead of one.

Another method of rooting a leaf is to place the leaf flat on top of the rooting medium, after making several cuts through the main veins with a razor blade. The more cuts made, the greater the chance of rot or desiccation. It is therefore a wise precaution to shake the leaf in a plastic bag containing a small amount of fungicide. Plantlets will grow around the edges of the cuts. This method is sometimes faster with species having tubers or rhizomes, as it will induce top growth which will not require a resting period.

Leaf cuttings may be rooted in water, but on removing from the liquid, the roots clump together and generally suffer considerable transplanting shock. Rooting medium will cling to the roots and make them much easier to handle.

Stem or tip cuttings of almost all gesneriads root easily. All cuts should be made with a sharp razor blade, to avoid crushing the plant tissue. Dust the stem ends with a rooting hormone containing a fungicide. Pieces 4 or 5 inches long are easy to handle. Remove leaves from the portion of the stem inserted into the rooting medium. Extra shoots from recently sprouted tubers or rhizomes root easily.

Offsets formed around the stem of rosette-type plants, such as *Boea* and some species of *Gesneria,* may be cut off and rooted.

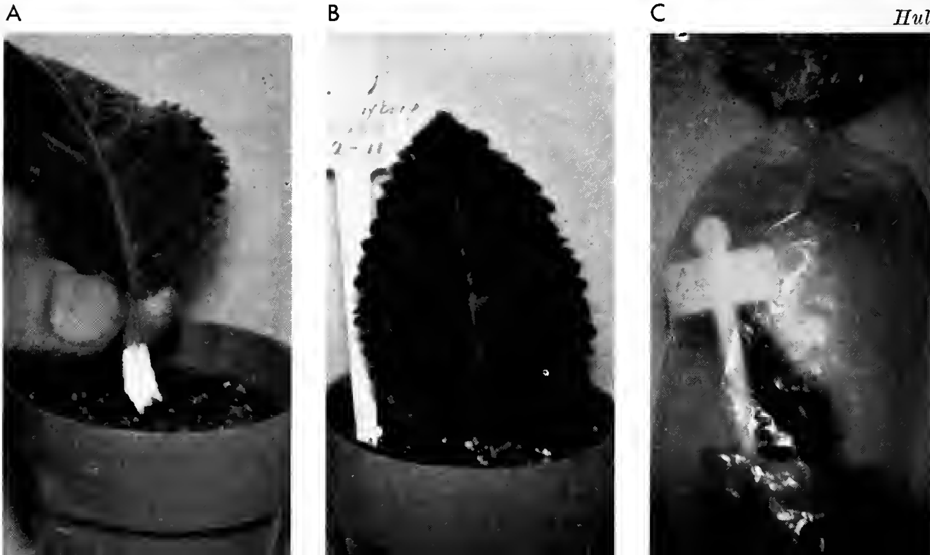
Stolons of *Episcia* may be pinned down to be rooted in separate pots before detaching from the mother plant.

Increase from Seed

Seeds may be slower than vegetative propagation in developing into flowering

To propagate a gesneriad from a leaf cutting: (A) Shorten the petiole to an inch or less, dip it in a rooting hormone and a fungicide, and (B) stand it upright in a moist, sterile mix in a 2-inch pot. Insert a label that gives the identity of the leaf and the date of propagation. On the reverse side record transplanting and other cultural data. (C) Enclose each potted leaf in an inflated polyethylene bag. Open the bag the third day. Roots should be formed within two weeks. Each cutting may then be placed in soil in a 2-inch pot. When the young plant's leaves extend beyond the rim, it is time for transplanting into a 4-inch pot. This is the procedure followed by Mr. and Mrs. Hull when propagating their prize-wining plants. (See pages 63—64.)

A B C *Hull*



plants, but they offer long-continued fascination for the grower.

Always open seed pods or packets of seed over a piece of white paper, as the seed is dust-fine. Level damp sterilized planting medium in the container. Regular potting soil, vermiculite, or milled sphagnum moss may be used. To plant, place seeds on a small piece of paper creased in the center and gently sprinkle seed over the soil. Do not cover the seed with additional soil. Cover the container with glass or plastic. Keep it in a warm place, out of direct sunlight, but not in the dark. Gesneriad seed usually germinates within two weeks, but old seed or some species may take much longer. Place the seed container in stronger light as soon as germination occurs. The tiny seedlings can endure some overwatering, but no drying out whatever. If growing in an inert medium, very dilute fertilizer should be watered in after germination.

Transplanting should be done as soon as the seedlings become crowded in the container. A plastic toothpick is a good tool for pricking out the seedlings. If the end of the pick is dampened, a tiny seedling will cling to it while being transported and inserted in a new container. Several transplantings are to be preferred to putting a small seedling in the size container it will need in a few months' time. ♦

FLORIST GLOXINIAS

(*Continued from page* 53)

Culture

Although a few species in these two genera (*Sinningia* and *Rechsteineria*) may be too large for most plant collections, many are suitable for growing under a variety of conditions and are well worth trying. Except as already noted, the culture of the species and their hybrids is similar and rather easy.

When dormant tubers start to sprout, plant them in a pot 2 to 3 inches larger across than the maximum diameter of the tuber. Use a standard potting soil, pasteurized or fumigated. One of many satisfactory mixes is equal parts of sand, peatmoss, and a good garden loam. Already prepared African-violet soil mixes are also suitable.

Partially fill the pot with soil, place the tuber in the pot, sprouted side up, and add more soil until the top of the tuber is about an inch below the soil surface. Water well and place in a sunny window. Until the shoots appear above the soil, water lightly and thereafter see that the soil is kept moist but not waterlogged. Remove all but one shoot, and rotate the pot once a week to keep growth symmetrical.

Before the plant starts to bud it will need about half a day of sun for best growth. Less sun is necessary during flowering. Shield the plant from the full intensity of the sun by a thin curtain except in winter months.

While the plant is budding and flowering, apply a dilute fertilizer solution every one to two weeks.

All gesneriads enjoy high humidity which you can provide by placing the pots on trays of wet pebbles with the water level in the tray kept below the pebble surface. Use of humidifiers will also help. Lack of humidity is often the principal cause of bud blast in the florist gloxinia.

After a plant has stopped flowering, keep it growing another four to six weeks so that it can store food in the tuber for the next blooming period. Then stop watering gradually, and remove the foliage when it has withered.

Store the tuber in the pot with an occasional light watering, or remove it and keep it in a plastic bag with slightly moistened peatmoss or vermiculite. The best storage temperature is about 60-65°. The dormant period lasts for approximately one to three months, sometimes to six months or more with a few of the rechsteinerias. ♦

PESTS AND DISEASES

Few are troublesome among gesneriads

Michael J. Kartuz

FORTUNATELY, pests and diseases seldom bother gesneriads in the home. Growers of African-violets (*Saintpaulia*) now and then become acquainted with a few attackers. In general, other gesneriads are hosts to the same pests. Directions given below will help to eliminate most of these trouble-makers.

Insects

Cyclamen Mite

Though probably the commonest and most serious pests of gesneriads, cyclamen mites are too small to be seen without a hand lens. Their presence is detected by the damage they do. Distorted, twisted foliage, streaked distorted flowers and stunted growth are symptoms.

Control may be achieved by using a miticide. Kelthane EC is very effective at the rate of 2 teaspoons per gallon. Apply as a spray, or dip plants in solution. Spray at least twice, one week apart. If trouble continues, alternate with some other miticide, such as Thiodan, to avoid the build-up of resistant strains.

Red spider and **broad mite** may occasionally attack gesneriads. Control is the same as for cyclamen mite.

Mealybugs and Scale

Mealybugs are soft, cottony white insects that lodge themselves in leaf axils, crowns and on undersides of leaves. Scale is less common, but may occasionally be found on smooth-leaved gesneriads. It is a waxy, yellowish, oval insect, about ¼ inch long. Its presence may also be noted by a black, sticky exudate.

Control by spraying with malathion, 50 per cent emulsifiable, at the rate of 1 tablespoon per gallon. Repeat sprayings may be necessary.

Thrips

This pest is mostly found in gesneriad blooms, and can cause premature flower drop, streaking of flowers and, in severe cases, distortion. Thrips are very small, slender insects, pale yellow when young, tan when mature. They jump and move rapidly when disturbed. Control with malathion, DDT or lindane. Thiodan may be effective against resistant types.

Aphids

Plant lice, or aphids, are small, soft-bodied insects, usually pale green in color. They cluster around flower stems and new growth. Almost any insecticide will kill them. For resistant strains, use nicotine sulfate.

Soil Pests

Nematodes

Nematodes, most of which infest the soil, are likely to be the second most serious pest of gesneriads. They cause general debility, which gives the plants a sickly, yellowish appearance in spite of good culture.

Root-knot nematode is the most common and is characterized by bead-like galls or lumps on the roots. Other types cause different kinds of root symptoms, such as clubbing.

There is no known effective cure, only prevention. Use sterilized soil and pots. Use saucers under your plants or set them on raised hardware cloth to prevent these pests from spreading. Nematodes can spread through a film of water.

Infested plants can be rescued by means of tip or leaf cuttings that are not in contact with or near the soil.

Foliar nematodes, while not a common pest, can occur. Symptoms are watery

brown spots that gradually enlarge on the undersides of leaves. Remove affected foilage. To prevent this nematode from spreading, avoid wetting the remaining leaves.

Pritchard Mealy Bug

This relatively new insect pest which feeds on roots can cause symptoms resembling those of nematodes. The insects are very small (1/16 inch or less), oval, and milky white. Control by drenching with Cygon 2E (dimethoate), ½ teaspoon per gallon, or by using aldrin 5 per cent granular, at the rate of 4 ounces per bushel of potting soil.

Other Root Pests

Symphilids are tiny thread-like insects that attack roots. Dust soil with chlordane. For serious infestations, control as for Pritchard mealy bug. Use pasteurized soil as prevention.

Springtails and **black flies** may cause damage when present in large numbers. Dust with chlordane, or control as for Pritchard mealy bug.

Diseases

Root Rot and Crown Rot

A sudden or even gradual wilting of a plant, combined with wet, soggy soil are surface evidences of root rot or crown rot. If root rot is the trouble, examination will reveal the roots to be brown and dead, rather than healthy white. If crown rot is the cause, the plant may come away from its roots at soil level with a slight tug. An affected plant may sometimes be saved by cutting away rotted areas and rerooting in a sterile rooting medium. However, tip or leaf cuttings, taken well away from the base of the plant, may be more certain.

As there is no cure except drastic action, prevention is the best method of control. Use porous, quick-draining pasteurized soil, or a sterile soilless mix.

Botrytis Blight

A gray mold that causes blooms and buds to go mushy and brown is evidence of botrytis blight. If left unchecked, leaves and stems will quickly rot away. It is encouraged by high humidity and poor air circulation. Remove spent and damaged flowers immediately. Avoid wetting plants during dark, cloudy weather.*

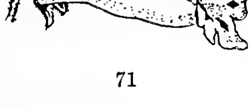
Powdery Mildew

Blossoms and stems of saintpaulias are the most frequent hosts of powdery mildew. This fungus is easily controlled with Karathane, ½ teaspoon per gallon, as a spray, or with sulfur dust. Good air circulation helps prevent infection.

Virus

Viruses, such as tobacco mosaic, have been known to infect gesneriads. Their presence may be noted by streaking and distortion of the leaves, ringed yellow spots and general lack of vigor of the plant. They are usually spread through insect or mite vectors. Since there is no cure, infected plants should be immediately destroyed. ◆

* The first line of defense for control of gray-mold or botrytis blight on gesneriads is to avoid high humidity and overfertilization, especially with nitrogen. Adequate spacing of the plants allows for better air circulation and faster drying of the plant surfaces. Remove and destroy immediately any diseased plant parts, and if spraying becomes necessary, apply captan or ferbam wettable powders at the rate of 2 tablespoons per gallon of water. Zineb 65 per cent wettable powder can be used at 1 tablespoon per gallon, or Karathane, ½ teaspoon per gallon. Mite control also helps for botrytis control.—J. T. W.



HYBRIDIZING GESNERIADS

How to proceed, with suggestions for future crosses in the light of significant work of the past

Robert E. Lee

ONE of the intriguing aspects of hybridization for amateur and professional alike is the hopeful expectation that develops if and when a progeny matures. Anticipation begins with the transfer of pollen, and grows each day during the growth of the seed pod, germination of seed and subsequent development until the hybrid flowers.

What Are Hybrids?

Hybrids are the result of crossing two unlike entities. These may be different genera, different species, or different plants of the same species. For example, if *Rechsteineria* is crossed with *Sinningia*, the result is an intergeneric hybrid. If *Smithiantha fulgida* is crossed with *Smithiantha multiflora*, the hybrid is called interspecific (between species). However if a yellow-flowered *Achimenes heterophylla* is crossed with an orange-flowered *A. heterophylla*, the term intraspecific (within the species) is used to designate the hybrids. The great majority, but not all, of the *Saintpaulia* clones are of intraspecific nature: crosses between different clones of *S. ionantha*. A clone consists of uniform material derived from a single individual, propagated entirely by vegetative means.

Some Hybridizing History

In addition to *Saintpaulia*, *Streptocarpus*, another member of the *Gesneriaceae* from the Old World, has also been the subject of extensive hybridization, primarily at the hands of European workers. Many interspecific hybrids, of which perhaps 'Constant Nymph' is one of the best known in this country, have been created. Although the first hybrid, *S. gardeni* × *S. polyanthus*, was recorded in 1859, most of the earliest crosses were concerned with *S. dunni*, *S. parviflorus* and *S. rexi*. The progeny were crossed with *S. cyaneus*, *S. polyanthus*, *S. saundersi*, *S. wendlandi* and *S. woodi* followed by backcrossing to the earlier parents. At least fifteen different interspecific combinations have been named. In this genus the acaulescent (without erect stem) types seem to be interfertile but they will not hybridize with the caulescent (with erect stem) type.

Seemingly the New World genera have been of more widespread interest on the part of plant beeders. *Achimenes*, *Columnea*, *Episcia*, *Kohleria*, *Rechsteineria*, *Sinningia* and *Smithiantha* have all offered parental material for interspecific, and in some cases, intergeneric hybrids.

Interest in interspecific hybrids of *Achimenes* dates back to the work started in Switzerland by Eduard Regel in 1848. Some of the early hybrids such as 'Camillo Brozzoni' are still in commerce. Since that time at least 65 different combinations of species have been obtained from the 20 species in cultivation. Although the species, varying in size, habit, morphology, and chromosome number, are divided into several taxonomic sections, no blocks to interspecific hybridization between members of different sections have been encountered.

The four species of *Smithiantha* in cultivation are also interfertile. Hybrids were introduced into the trade as early as the mid-19th century. In the latest Gesneriad Register over 50 named inter- and intraspecific hybrids of both American and European origin are listed.

Of particular interest is the fact that it is a simple matter to obtain intergeneric hybrids between *Achimenes* and *Smithiantha*, to which the name × *Eucodonopsis*[*] was given in 1865. To date at least 15 different combinations of *Smithiantha* and *Achimenes* have been used in the × *Eucodonopsis* hybrids already produced, Six taxonomic sections of *Achimenes* are represented in these hybrids.

In the literature of 1857 there is a record of a hybrid between *Smithiantha zebrina* and *Heppiella viscida* which has been called × *Heppiantha*. No plants of this hybrid nor of the *Heppiella* parent are known to be in cultivation today.

The name "Smithennis" appears in catalogs for a hybrid between a *Smithiantha* and *Gloxinia perennis*.

Although the earliest record of the introduction of a *Columnea* species into Europe was 1759, apparently hybrids did not appear there or elsewhere until 1914. More recently the work of American breeders has increased the list of named cultivars of hybrid origin to over 60. As with *Achimenes,* hybrids are easily obtained between the various taxonomic sections of the genus in spite of diversity in habitat, as well as in size and shape of flowers and foliage. Over 90 different interspecific hybrids have been documented. One, *C.* 'Cascadilla' is a dihybrid: a cross between two hybrids involving four parental species (*C. gloriosa* × *C. lepidocaula*) × (*C. crassifolia* × *C. nicaraguensis*). Interestingly enough, in spite of its complex parentage, it often sets open-pollinated seed.

Most of the *Episcia* hybrids in commerce are intraspecific: crosses between variant clones of *E. cupreata,* although some are the result of intercrossing clones of *E. lilacina.* However, there are hybrids between *E. lilacina* and *E. cupreata,* between *E. cupreata* and *E. reptans,* and a hybrid between *E. dianthiflora* and *E. punctata.* It appears that an episcia will hybridize only with members of the same taxonomic section, as there has been no success yet in attempts to cross members of different sections, for example, *E. dianthiflora, E. punctata, E. melittifolia* or *E. decurrens* with either *E. cupreata* or *E. lilacina.*

Published descriptions of *Kohleria* hybrids date to 1854 when European breeders worked with many of the rhizomatous species having showy flowers. Species that figured in early hybrids include *K. bogotensis, K. digitaliflora, K. ferruginea, K. hondensis, K. ocellata, K. magnifica* and *K. warszewiczi.* In many cases one parent was known but not the other. The 'Sciadotydaea' hybrids were the result of crossing either *K. digitaliflora* or *K. warszewiczi* with unknown species of the *Tydaea* section of the genus. *K. eriantha* and *K. amabilis* have also entered into the parentage of many hybrids.

The genus *Sinningia* has long been given attention by hybridizers. In 1837 a hybrid of *Sinningia speciosa* and *S. velutina* was described. Other hybrids of that era incorporated such species as *S. barbata, S. conspicua* and *S. guttata.* For more recent work see "Florist Gloxinias and Their Kin" by Carl Clayberg (pages 49—53).

About the same time as the early interspecific hybrids were made, intraspecific hybrids between clones of *S. speciosa* appeared. The first were improvements in the 'Maxima' group of slipper gloxinias. By 1845 the type of 'Fyfiana' hybrids with erect flowers—the common florist gloxinia of today—were available. They were immediately exploited by European hybridizers and even today continue to be a favorite subject for both European and American breeders.

Sinningia has also figured in intergeneric hybrids. The first × *Gloxinera,* of which the parents were *Sinningia speciosa* and a *Rechsteineria,* appeared in 1894 in England. Several other species of both genera have been combined more recently.

Periodically since 1892, reports have been made of hybrids between *Sinningia*

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[*] When the cross that indicates hybridization appears before a generic name, it is read "the hybrid genus" so-and-so—in this instance *Eucodonopsis.*

J. D. Batcheller

Species of *Kohleria* have been used for breeding since the 1850's. 'Rongo' (*K amabilis* × *K. sciadotydaea*) is a recent hybrid of Mrs. Joseph D. Batcheller's. The flowers are a bright magenta and the foliage is dark mottled green.

and *Streptocarpus*, which have been called "Stroxinia." Until controlled experimental breeding corroborated by cytological investigations authenticate such a cross, it remains in the realm of the skeptical.

Suggestions for the Amateur

Because the foregoing may incite interest and activity on the part of hybridizers, some practical suggestions for the novice may be pertinent. Necessary equipment is minimal: a small camel's-hair brush, a pair of sharp-pointed tweezers, a pencil, some small plastic or paper tags and a record book.

If you are not familiar with the essential parts of a flower, take an open flower; if it is tubular slit it with a needle from base to tip. The stamens are often attached to the corolla and come off with the corolla if it is removed. Stamens are composed of slender stalks with the anthers or male parts at the tip. The anthers are sacs that contain the pollen, a dust-like powder which is often yellow. The female element is composed of (1) the ovary at the base of the flower, which develops into the seed pod; (2) the style, which is a narrowly elongate connective; and (3) at its tip, the stigma.

In the *Gesneriaceae* the anthers commonly open and shed pollen as soon as, and in some cases before, the flower opens. At this time the stigma is usually not receptive, a natural mechanism to prevent self-pollination. After a few days, the style elongates and the tip or stigma enlarges. It may be spread into lobes or, among other forms, be mouth shaped, or club shaped. When the stigma is receptive it becomes sticky so that pollen applied to it will adhere and germinate. The length of time between the opening of the flower and the stage of receptivity of the stigma varies according to species, from a day or so for those flowers which are ephemeral as in some *Nautilocalyx*, to as much as a week or more for some *Columnea* species.

It is always best to emasculate the flowers of the seed parent by removing

the anthers in the bud stage a few days before the flower opens to insure that no pollen of the flower falls on its own stigma to produce inadvertently a self-pollination. Slit the corolla with a needle, a pin, or the sharp point of the tweezers and remove the anthers with the tweezers. When the stigma of an emasculated flower is receptive, freshly opened anthers from the pollen parent can be removed intact with tweezers. Brush the anther lightly across the stigma of the seed parent so that an obvious deposit of pollen adheres to the stigma. An alternate method is to collect newly opened anthers in a capsule, and use a camel's hair brush to transfer the pollen to the stigma. In any case, it is wise to dip the brush or tweezers in alcohol or other strong disinfectant to remove any pollen grains before making a pollination involving different pollen parents. The brush should be dry before being used. For very small fragile flowers or those with a very small throat, a wire, or sometimes even the sharp pointed end of the tweezers can be used to transfer the pollen.

Where there is danger of insect pollination, the tip of the pollinated flower can be closed with a very fine wire. If the style length differs considerably in the parents, put the pollen of the longer styled parent on the stigma of the shorter. Often when pollination is successful, the flower wilts within a day or so after having been pollinated and the corolla may fall off.

How to Keep Records

A small plastic or paper tag is secured to the pedicel of the pollinated flower, indicating in pencil (ink may run when the plant is watered) the parents and the date. It is customary practice to list the female parent first, then a cross sign followed by the male parent. You should be consistent in this procedure, then if seed pods and tag are collected and put in individual envelopes or other containers, you will always know that the first parent listed is the seed parent even though the seeds have been removed from the plant. The final step is to list the crosses in a record book. List the cross and make a check mark for each flower pollinated. When seed is harvested, the check can be circled and you will know how many were successful, how many harvested, and how many may still remain on the plant.

If you are an active hybridizer, it may be more convenient to give your plants numbers, as they take less space on a tag or label than plant names. When hybrid seeds are sown, the particular cross can be given a number. If space limits your progeny to 26 or less seedlings, they can be designated with the number of the cross and the letters from A to Z to identify each seedling of a cross. Of course it is essential to keep records accurately. It is also important to keep records of parents and progeny for future reference so that you can tell the lineage of any particular hybrid, especially if you go beyond one generation. If there is variation in a population of hybrids, it would be worth while to have a record of this: how many pink, how many white, how many red, the number with mottled foliage and the number unmottled, the number of dwarfs and the number of non-dwarfs, etc., all items for the record book. If there is no variation, the word 'uniform' after the cross will suffice. The percentage of viable seed might be another factor worth recording.

If you self-pollinate a plant, the conventional method is to list the plant name or number followed by a cross within a circle. A self-pollination may be made using the pollen of a flower placed on the stigma of the same flower, or the pollen of another flower from the same plant, or the pollen from another plant of the same clone.

Storing of Pollen

Pollen from newly opened anthers is most reliable. However, if the two plants to be hybridized do not flower at the same time, try to store pollen of the first one to go out of bloom. Fresh pollen can be

Schulz

Two intergeneric hybrids between *Sinningia* and *Rechsteineria* developed by Peggie Schulz of Minneapolis. *Left:* an F_2 *Gloxinera* with shell-pink flowers on a compact plant, created by crossing *S. eumorpha* with *R. cyclophylla,* then breeding the offspring with *S. eumorpha.* *Right:* an F_3 hybrid made by breeding *R. "splendens"* (perhaps a form of *R. cardinalis)* with *S. eumorpha,* then selfing the offspring and breeding the next generation with *R. "splendens"* again. The individual flowers, which are lavender, remain in good condition for six weeks.

stored in gelatin capsules in a desiccator in a refrigerator. An improvised desiccator can be made of an air-tight container such as a wide-mouth fruit jar by placing solid calcium chloride granules or silica gel in the bottom with a piece of screen above them as a support for the vials or bottles to be stored. Pollen of *Achimenes, Rechsteineria* and *Sinningia* has been successfully refrigerated.

If pollen is to be frozen, it must first be placed in open vials or bottles in an airtight desiccator for 4 to 6 hours to remove any moisture. Then the vials containing the pollen should be tightly closed and placed in a closed desiccator in a freezer. This method has been successful with pollen of *Rechsteineria* and *Sinningia.*

Limits of crossability are difficult to state definitely except that a hybrid between a gesneriad and a plant not in that family is most improbable. Intergeneric crosses are possible in cases of some closely related genera, but are not frequent. Interspecific crosses are more often successful, but not always, while intraspecific crosses are usually easily obtained unless the species are in different taxonomic sections of the genus.

Significance of Chromosomes

The number of chromosomes in the ovule (or egg cell) and in the pollen grain may be a guide, but just because two plants have the same number, there is no guarantee of success. *Alloplectus, Chrysothemis, Columnea, Drymonia* and *Nautilocalyx* all have a chromosome number of $n=9$, but they are probably too divergent in evolution to hybridize with each other. *Nematanthus* of the New World and *Boea* of the Old World each have a number of $n=8$ but are too removed from each other generically and in evolution to hybridize.. However, *Achimenes* with $n=11$ will produce hybrids with those *Achimenes* that are $n=12$ and with natural tetraploids of $n=22$ or $n=24$, as well as with the closely related genus *Smithiantha* with $n=12$. If there is a difference in chromosome number of the plants to be crossed, it is recommended that the one with the larger number be the seed parent and the one with the smaller number be the pollen parent.

Hybrids that are fertile should not be the end of the line. First generation

hybrids (F_1) may be intermediate between the parents as demonstrated by incomplete dominance, a blending of characteristics, or they may exhibit complete dominance of certain parental characteristics. An F_1 hybrid population should be selfed to obtain an F_2 generation if each of the parents shows a number of desirable characteristics. Particularly where there is incomplete dominance, it may be worth while to backcross the F_1 or selections from an F_2 generation to one of the parents having a particularly desirable characteristic. An overly simplified example may prove the point for going beyond the F_1. If tall and blue are dominant, and dwarf and white are recessive, the F_1 hybrid of a cross between a tall blue and a dwarf white would all be tall and blue if complete dominance exists. If the F_1 is selfed, the F_2 generation would produce some tall blue, some tall white, some dwarf blue and some dwarf white, were a large enough population grown. This is an example of recombination of characteristics. Consult an elementary book on botany, genetics or plant breeding for an elaboration of the factors involved.

Hybrids between closely related species often produce at least a certain percentage of viable pollen and egg cells. A plant that results from crossing species not so closely related may produce hybrids that are male sterile, with no viable pollen, although in some cases a few ovules may be viable. Hybrids obtained from parents distantly related, yet close enough to be crossed, may be both male and female sterile. One caution: high temperatures, low humidity, and poor cultural conditions may cause temporary sterility such as abortion of pollen and even abscission of flowers, but these may be overcome when conditions improve.

Insofar as is known, there is no evidence of self-incompatibility in the family with the possible exception of *Titanotrichum oldhami*. There are no records of anyone having obtained seed of this species. This may or may not be a self-incompatibility. A plant is sterile if it is not capable of forming seed. Self-incompatibility exists when a plant produces good pollen and functional ovules, and does not set seed with its own pollen, but will set seed if pollinated with the pollen from another plant (not of the same clone) of the same species.

The Use of Tetraploids

Sterility in hybrids may be overcome by inducing tetraploidy. A hybrid may be sterile because the chromosomes do not have a like partner with which to pair. However, if the chromosome number is doubled, then each chromosome will have its double with which to mate and the sterility problem is solved. This is a technique for those more scientifically inclined and trained. It utilizes colchicine, a chemical agent often used to induce doubling of the chromosomes.

Tetraploids (4n) have twice the number of chromosomes that diploids (2n) have. In a diploid, the n number of chromosomes in the pollen joins the n number in the ovule to produce a seedling with two sets of chromosomes. If the chromosomes are doubled in nature or in the laboratory, there will be two sets in the pollen and two sets in the ovule, and the seedling will have four sets—a tetraploid. If the pollen of a diploid (n) fertilizes an ovule of a tetraploid (2n) the seedling will be a triploid ($n + 2n = 3n$). In some plant families, triploids may be superior to either diploids or tetraploids.

Natural tetraploid series have been reported for *Achimenes, Aeschynanthus, Alloplectus, Briggsia, Chirita, Columnea, Gesneria* and *Nautilocalyx,* in hybrids of *Sinningia, Smithiantha* and *Streptocarpus* and in clones of *Saintpaulia.* Induced tetraploids have been obtained by using colchicine in *Columnea, Sinningia,* × *Eucodonopsis* and × *Gloxinera.*

The purpose of inducing tetraploidy is to overcome sterility in hybrids, to produce plants that may exhibit "gigas" characteristics, such as larger flowers, larger leaves or stronger stems, and as a step in obtaining **triploids.**

There are various methods of using colchicine to create tetraploids: pretreatment of seeds before germination, treatment of growing points of seedlings, or treatment of storage organs or stems. The pretreatment of seeds consists of preparing a very dilute solution of colchicine in distilled water. Concentration of the solution may have to be varied for different species but usually falls between 0.05% and 1%. A piece of absorbent paper such as filter paper or facial tissues is saturated with the colchicine solution, placed in a dish or container, the seed placed on the saturated paper, and the dish covered to prevent evaporation. Length of treatment necessary to be effective may vary from 12 to 36 hours for quickly germinating seed such as most gesneriads. After the pretreatment, sow the seed in the usual manner.

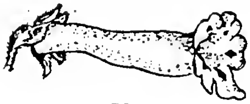
Stems may be treated at a node where new shoots are expected with a paste of 1% colchicine in lanolin. Growing points of seedlings may be treated by applying a colchicine solution with an eyedropper or atomizer to very young seedlings three times a day for three to five days. The suggested concentrations might vary from 0.1% to 0.25%. Tetraploids of plants with scaly rhizomes have been obtained by separating the rhizome into individual scales in the spring before the rhizome is ready to sprout, and soaking them in a 0.1% solution of colchicine for two or three hours.

Colchicine is a strong poison. Be certain to wash well if any of the chemical or solution comes in contact with the skin.

Future Possibilities

The work done by breeders with *Achimenes*, *Aeschynanthus*, *Columnea*, *Episcia*, *Kohleria*, *Sinningia* and *Rechsteineria* as well as the myriad clones of *Saintpaulia* demonstrates the possibilities to be achieved by hybridization. The genus *Gesneria* has not been touched, nor has *Hypocyrta*, both with diverse species. *Kohleria* still offers possibilities; the tiny *Diastema*, also rhizomatous and in the same tribe with *Kohleria*, might be tested for compatibility with *Kohleria*. In fact, the tribe *Gloxinieae*, which includes *Gloxinia*, *Achimenes*, the diminutive *Koellikeria*, *Smithiantha*, *Heppiella* and *Seemannia*, might offer interesting possibilities for intergeneric hybrids. *Lietzia*, in the same tribe with *Rechsteineria* and *Sinningia*, might supply new germ plasm. *Chirita* is another genus that might be considered because of the diversity of species. Some one must certainly test the compatibility of *Rhynchoglossum notonianum* from the Orient with those species native to the New World, with possible horticulturally valuable plants to be found among the progeny. The generic limits of *Columnea* and *Alloplectus* as well as of *Nautilocalyx* and *Episcia* are not as well understood as might be desired. The possibility of bridges between those species in either grouping would provide an intriguing project, and who knows what kind of progeny would result! As new species in any genus are introduced, they may be the source of new germ plasm, such as the recently available dwarf *Streptocarpus cyanandrus* and *S. rimicola*.

Since spontaneous mutation is inevitable, selfed populations of almost any interesting species could be grown just to see what variation might appear and if it were worth exploiting. The *Gesneriaceae* make excellent subjects for hybridization because of the ease of vegetative propagation of most members of the family. Sterilities may hinder further breeding in a certain line but are no impediment to widespread dissemination of anything worth while, because propagation by rhizomes, tubers, stem cuttings, leaf cuttings, runners and stolons is so easily achieved. With sex such a dominant theme in contemporary life, it is time plants came in for their share, and fortunately without the necessity of Freudian implications. ♦



CHROMOSOME NUMBERS IN THE GENERIACEAE

Achimenes
andrieuxii 12 Cooke
antirrhina 11 Cooke
bella 24 Lee
candida 11 L&G
cettoana 11 Cooke
dulcis 11 Lee
ehrenbergii 12 Cooke
erecta 22 Lee
fimbriata 11 Cooke
flava 11 Cooke
glabrata 11 L&G
grandiflora 11 Eberle
heterophylla 11 L&G
longiflora 11 Eberle
mexicana 11 L&G
misera 22 Lee
obscura 11 L&G
patens 11 L&G
pedunculata ca. 17 Fussell
skinneri ca. 11, ca. 17 Fussell
warszewicziana 11 Fussell
woodii 11 Cooke

Aeschynanthus
ellipticus 32 48 Ratter
grandiflorus 15 Rogers, 16 Eberle
hosseussii 16 Ratter
lamponga 32 Eberle
longiflorus 15 Ratter
marmoratus 15 Ratter
micranthus 15 Lee
nummularius 32 Ratter
parasiticus 16 Ratter
parviflorus 16 Ratter
parvifolius 32 Eberle
perakensis 15 R&P
pulcher 32 Ratter
obconicus 16 R&P
sikkimensis 16 Ratter
speciosus 32 Eberle
x splendidus 16 R&P
tricolor 16 Eberle

Agalmyla
parasitica 16 Fussell

Alloplectus
ambiguus 18 Lee
capitatus 9 Eberle
domingensis 9 Rogers
schlimii 9
speciosus 9 Lee
vittatus 9 Eberle

Ancyclostemon
convexus 17 R&P

Beccarinda
cordifolia 10 R&P

Bellonia
spinosa 13 Lee

Besleria
lutea 16 Lee

Boea
hygroscopica 8 Lee
magellanica 8 R&P
lawesii 8 R&P

Briggsia
aurantiaca 17 Ratter
muscicola 34 R&P

Chirita
anachoreta 9 Ratter
asperifolia 14 Lee, 16 R&P
caliginosa 9 R&P
lavandulacea 17 Ratter
macrophylla 9 R&P
pumila 4 Ratter
sericea 9 Ratter
sinensis 18 R&P
trailliana 9 Ratter
urticifolia 17 R&P
zeylanica 10 R&P

Chrysothemis
friedrichsthaliana 9 Lee
pulchella 9 Lee

Codonanthe
crassifolia 16 Fussell
macradenia 16 L&G
triplinervia 8 Lee

Columnea
affinis 9 Fussell
allenii 9 Fussell
arguta 9 Fussell
aureonitens 9 Lee
x banksii 9 Rogers
brevipila 9 Lee
consanguinea 9 Sherk
crassifolia 9 Fussell
x euphora 9 Fussell
fawcettii 9 Lee
flaccida 9 L&G
glabra 9 Sherk
gloriosa 9 Rogers
hirsutissima 9 Lee
hirta 9 Eberle
hispida 9 Lee
illepida 9 Sherk
x kewensis 9 Eberle
kucyniakii 9 Lee
lepidocaula 9 Rogers
linearis 9 Fussell
magnifica 9 Lee
microphylla 9 Eberle
moorei 9 Sherk
mortonii 9 Lee
nicaraguensis 9 Sherk
oerstediana 9 Fussell
percrassa 9 Lee
pilosissima 9 Fussell
querceti 9 Sherk
rubricaulis 9 Lee
sanguinea 18 Fussell
sanguinolenta 9 Sherk
scandens 9 Lee
schie leana 9 Rogers
teuscheri 9 Lee
translucens 9 Lee
tulae 9 Fussell
verecunda 9 Sherk
warszewicziana 9 Sherk
zebrina 9 Lee

Conandron
ramondioides 16 R&P

Cyrtandra
biflora 17 R&P
oblongifolia 17 R&P
paludosa 17 R&P
pendula 17 R&P
radiciflora 17 R&P
splendens 17 R&P

Diastema
maculata 13 L&G
quinquevulnerum 13 Lee
rupestre 13 Lee
vexans 13 Fussell

Dichiloboea
speciosa 18 R&P

Dichrotrichum sp. 16 R&P

Didymocarpus
innominatus 16, 32 R&P
praeteritus 12 R&P
purpureus 16 R&P
siamensis 27 R&P
tomentosus ca. 45 R&P

Drymonia
macrophylla 9 Rogers
mollis 9 Ratter
parviflora 9 Lee
serrulata 9 Ratter
stenophylla 9 Lee

Episcia
cupreata 9 Rogers
decurrens 9 Lee
dianthiflora 9 Fussell
lilacina 9 Rogers
melittifolia 9 Lee
punctata 9 Rogers
reptans 9 Rogers

Fieldia
australis ca. 40 Ratter

Gesneria
acaulis 14 Lee
albiflora 14 Lee
christii 14 Lee
citrina 14 Lee
cuneifolia 28 Lee
var. 'El Yunque' 14 Lee
exserta 14 Lee
jamaicensis 14 Lee
pauciflora 14 Lee
pumila 14 Lee
ventricosa 14 Lee

x Gloxinera 13 Fussell

Gloxinia perennis 13 Rogers

Heppiella corymbosa 14 Lee

Hypocyrta
glabra 8 Ratter
nervosa 8 Lee
nummularia 9 Rogers
perianthomega 8 Lee
radicans 8 Ratter
selloana 8 Lee
strigillosa 8 Ratter
wettsteinii 8 L&G

Koellikeria erinoides 13 Fussell

Kohleria
bogotensis 13 Fussell
elegans 11 Lee
eriantha 13 Eberle
lindeniana 13 Rogers
longifolia 13 Lee
schiedeana 13 Lee
x sciadotydaea 13 Rogers
spicata 13 Rogers
tubiflora 13 Lee

Lysionotus serratus 16 R&P

Mitraria coccinea ca. 37 Ratter

Monophyllaea
horsfieldii 10 R&P

Monopyle maxonii 13 Lee

Nautilocalyx
bullatus 9 Rogers
forgettii 9 Eberle
lynchii 18 Rogers
villosus 9 Lee

Negria
rhabdothamnoides ca. 45 R&P

Nematanthus
fluminensis 8 L&G
longipes 8 Ratter

Niphaea oblonga 11 Lee

Opithandra
primuloides 17 Ratter

Ornithoboea
wildeana ca. 16 R&P

Paliavana sp. 13 Lee

Paraboea
capitata 18 R&P

Legend: L&G = Lee & Grear; R&P = Ratter & Prentice

vulpina ca. 18 R&P

Petrocosmea
kerrii 17 Ratter
parryorum 17 R&P

Phinaea
multiflora 13 L&G
repens ca. 26 Lee

Ramonda
myconii 24 Ratter
nathaliae 24 Ratter
serbica 36 Glisac

Rechsteineria
cardinalis 13 Eberle
lindleyi 13 Fussell
macropoda 13 Eberle
warszewiczii 13 Fussell

Rhabdothamnus
solandri ca. 37 Ratter

Rhynchoglossum
notonianum 10 Eberle
papuae 27 R&P

Rhynchotechum
discolor 10 Ratter

Rhytidophyllum
auriculatum 14 Lee
tomentosum 14 Eberle

Saintpaulia
confusa 15 Fussell
grotei 15 Wilson
intermedia 15 Ratter
ionantha 15 Wilson
magungensis 15 Fussell
pendula 15 Ratter
orbicularis 15 Fussell
shumensis 15 Fussell
teitensis 15 Ratter
tongwensis 15 Wilson

Sarmienta
repens ca. 37 Ratter

Seemannia
latifolia 13 Lee
sylvatica 13 Lee

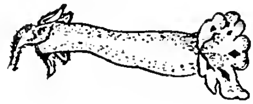
Sinningia
barbata 13 Fussell
hirsuta 13 Ratter
pusilla 13 Eberle
regina 13 Lee
schiffneri 13 Lee
speciosa 13 Rogers
tubiflora 13 Clayberg

Smithiantha
cinnabarina 12 Rogers
fulgida 12 Lee
multiflora 12 Fussell
zebrina 12 Rogers

Solenophora
purpusii 10 Lee

Streptocarpus
caulescens 15 Ratter
comptonii 16 Lawrence
confusus 16 R&P
cooksonii 16 R&P
cyanandrus 16 R&P
cyaneus 16 Lawrence
davyi 16 R&P
denticulatus 16 R&P
dunnii 16 Lawrence
eylesii 16 R&P
galpinii 16 Lawrence
gardenii 16 Lawrence
gracilis 16 Lawrence
grandis 16 Lawrence
haygarthii 16 Lawrence
hilsenbergii 15 Ratter
holstii 15 Lawrence
insighis 16 Lawrence
johannis 16 R&P
kirkii 15 Lawrence
micranthus 16 R&P
michelmorei 16 Lawrence
molweniensis 16 R&P
montanus 16 R&P
nobilis 15 R&P
polackii 16 Lawrence
polyanthus 16 Lawrence
prolixus 16 R&P
rexii 16 Lawrence
rimicola 16 R&P
saundersii 16 R&P
saxorum 15 Lawrence
umtaliensis 16 R&P
wendlandii 16 Lawrence

Titanotrichum
oldhamii 20 Fussell



CLASSIFICATION OF GESNERIAD GENERA

Old World Subfamily—*Cyrtandroideae*

Cyrtandreae
Cyrtandra
Hexatheca
Protocyrtandra
Rhynchotechum
Sepikaea

Trichosporeae
Aeschynanthus
Agalmyla
Dichrotrichum
Euthamnus
Loxostigma
Lysionotus
Micraeschynanthus
Oxychlamys

Klugieae
Epithema
Monophyllaea
Moultonia
Rhynchoglossum

Loxonieae
Loxonia
Stauranthera
Whytockia

Didymocarpeae
Acanthonema
Ancyclostemon
Anna
Beccarinda
Boea
Boeica
Bournea
Briggsia
Cathayanthe
Championia
Chlamydoboea
Chirita
Codonoboea
Conandron
Corallodiscus
Dasydesmus
Didissandra
Didymocarpus
Dichiloboea
Haberlea
Hemiboea
Isometrum
Jankaea
Leptoboea
Linneaopsis
Loxocarpus
Orchadocarpa
Oreocharis
Ornithoboea
Opithandra
Paraboea
Petrocodon
Petrocosmea
Phylloboea
Primulina
Platystemma
Ramonda
Raphiocarpus
Rhabdothamnopsis
Saintpaulia
Streptocarpus
Tengia
Tetraphyllum
Trachystigma
Tremacron
Trisepalum

Unclassified
Titanotrichum

New World Subfamily—*Gesnerioideae*

Beslerieae
Besleria
Cremosperma
Pterobesleria

Columneae
Alloplectus
Chrysothemis
Codonanthe
Columnea
Drymonia
Episcia
Hypocyrta
Nautilocalyx
Nematanthus

Bellonieae
Anodiscus
Bellonia
Monopyle
Niphaea
Phinaea

Gloxinieae
Achimenes
Gloxinia
Heppiella
Koellikeria
Seemannia
Smithiantha

Kohlerieae
Capanea
Diastema
Kohleria
Paliavana
Vanhouttea

Sinningieae
Lietzia
Rechsteineria
Sinningia

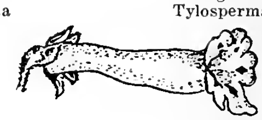
Solenophoreae
Solenophora

Gesnerieae
Gesneria
Rhytidophyllum

Coronanthereae
Coronanthera
Depanthus
Negria
Rhabdothamnus

Mitrarieae
Asteranthera
Fieldia
Mitraria
Sarmienta

Unclassified
Anetanthus
Lembocarpus
Napeanthus
Resia
Rhoogeton
Tylosperma



GESNERIAD SUPPLIERS

Plant Material

George W. Park Seed Co., Greenwood, South Carolina 29646. Seeds and plants. Free catalog.

Granger Gardens, Route 2, 1060 Wilbur Road, Medina, Ohio 44256. Plants. List .10. Saintpaulias, Columneas, some other gesneriads.

Buell's Greenhouses, Eastford, Connecticut 06242. Gloxinia plants and seeds. Very wide selection of gesneriads, including their own hybrid florist gloxinias. Culture handbook and catalog, $1.00.

J. A. Peterson Sons, 3132 McHenry Avenue, Cincinnati, Ohio 45211. Wholesale only. Saintpaulias and many other gesneriads.

L. Easterbrook Greenhouses, 10 Craig Street, Butler, Ohio 44822. Plants of many gesneriads. List .15.

Spidell's, Junction City, Oregon 97448. P. O. Box 93. Plants, Saintpaulias and other gesneriads.

Lyndon Lyon, 14 Mutchler St., Dolgeville, New York 13329. Plants. Saintpaulias, Columneas, Achimenes, and other gesneriads.

Susan Feece, Rt. #3, Box 947, Walkerton, Indiana 46574. Plants. Episcias a specialty.

Kartuz Greenhouses, 92 Chestnut Street, Wilmington, Massachusetts 01887. Plants. Very wide selection of gesneriads, including his own hybrids. Catalog .25.

Fischer Greenhouses, Linwood, New Jersey 08221. Plants. Saintpaulias, gloxinias and some other gesneriads. Catalog .20.

Whistling Hill Greenhouses, Box #27, Hamburg, New York 16075. Unusual gesneriads.

Antonelli Brothers Gardens, 2545 Capitola Road, Santa Cruz, California 95062. Plants. Streptocarpus, gloxinias and other gesneriads. Catalog .25.

Norvell Greenhouses, 318 S. Greenacres Road, Greenacres, Washington 99016. Plants. Saintpaulias and other gesneriads.

House of Plants, 26 Hotchkiss Street, S., Binghamton, New York 13903. Plants. Achimenes a specialty, most other gesneriads except Saintpaulia.

Tropical Gardens, R. R. 1, Box 143, Greenwood, Indiana 46142. Saintpaulias, columneas, episcias.

Growing Supplies

Bernard D. Greeson, 3548 N. Cramer St., Milwaukee, Wisconsin 53211. List .10.

Harvey J. Ridge, 1126 Arthur Street, Wausau, Wisconsin 54401. List .10.

The House Plant Corner, Box 860, Oxford, Maryland 21654. List .20.

BOOKS ABOUT GESNERIADS

African Violets, Gloxinias, and their Relatives, Harold E. Moore, Jr., Macmillan, 1957. $10.00

New Complete Book of African Violets, Helen Van Pelt Wilson, M. Barrows & Co. Revised 1963. $5.95

Gloxinias and How to Grow Them, Peggie Schulz, M. Barrows & Co. Revised 1965. $4.50.

Buell's **Culture Handbook.** Buell's Greenhouses, Eastford, Conn. 06242. $1.00

American Gloxinia and Gesneriad Society **Cultural Handbook.** .25

Gesneriads and How to Grow Them. Edited by Peggie Schulz. Diversity Books, 1967. $7.95

Fluorescent Light Gardening. Elaine C. Cherry. Van Nostrand, 1965. $6.95

African Violet and Gesneriad Questions Answered by 20 Experts. Helen Van Pelt Wilson, editor. Van Nostrand, 1966. $6.95

GESNERIAD SOCIETIES

African Violet Society of America—P. O. Box 1326, Knoxville, Tennessee, 37901. Membership, $4.00, includes subscription to *African Violet Magazine*, quarterly.

American Gesneria Society—Membership Secretary, Theodore Bona, 505 S. 12th St., Reading, Pennsylvania 19602. Membership, $3.50, includes subscription to *Gesneriad Saintpaulia News*, 6 issues a year. Seed Fund.

American Gloxinia and Gesneriad Society, Inc.—Membership Secretary, Mrs. Diantha Buell, Eastford, Connecticut 06242. Membership, $4.00, includes subscription to *The Gloxinian*, 6 issues a year. Seed Fund.

Indoor Light Gardening Society of America, Inc.—Membership Secretary, Mrs. Fred D. Peden, 4 Wildwood Road, Greenville, South Carolina 29607.

BROOKLYN BOTANIC GARDEN RECORD

PLANTS & GARDENS

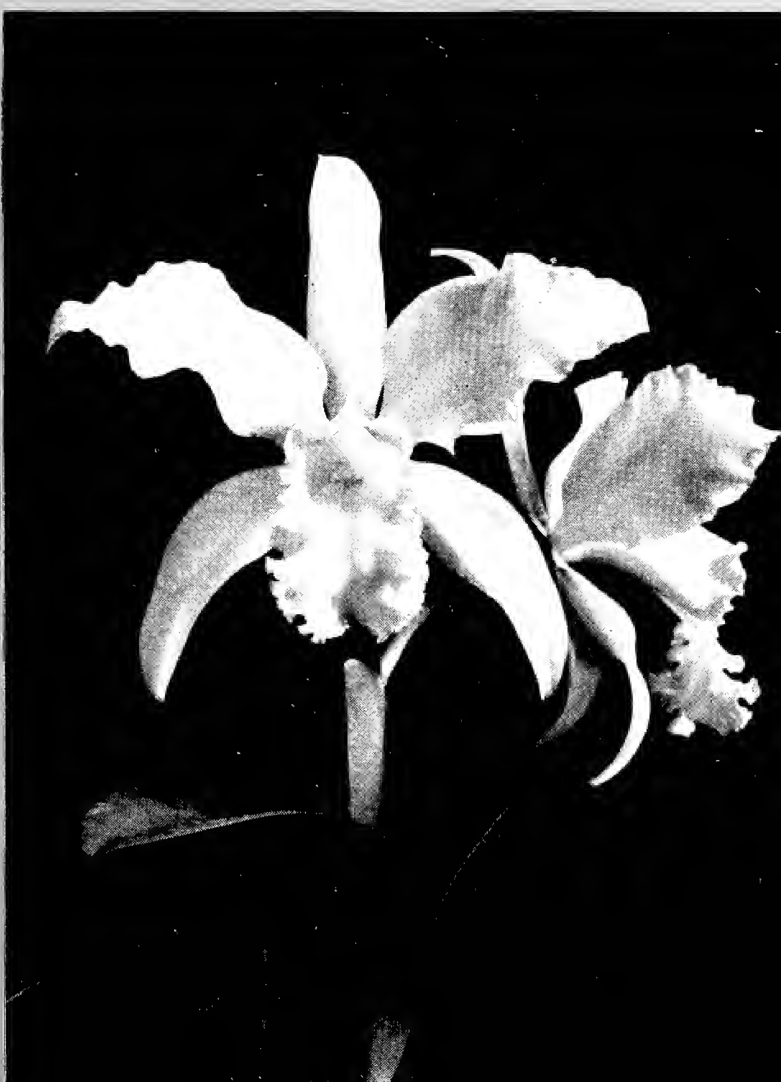
HANDBOOK ON ORCHIDS

Cultural Notes for
Growing Orchids
In the House
On Windowsills
or Under Lights
In Greenhouse
or Outdoors

Propagation
Pest Control

Native Species
Exploration
Conservation

Sources of
Plants
Supplies and
Information



SUMMER
1967

NEW SERIES
VOL. 23 No. 2

AMONG THE CONTRIBUTORS

A. G. ALPHONSO is Director of the Singapore Botanic Gardens, where extensive efforts are being made to keep native orchids from becoming extinct.

JOSEPH ARDITTI is a plant physiologist who has been interested in orchids ever since he was an undergraduate at the University of California. He is Assistant Professor of Biological Sciences in the Department of Organismic Biology at the University of California at Irvine. He has collected in Alaska and in tropical America and is the author of numerous papers.

JOHN W. BLOWERS received his horticultural training at the Royal Botanic Gardens, Kew, England. He is editor of the world's oldest periodical on orchids, *The Orchid Review*, and Secretary of the Royal Horticultural Society's Orchid Committee. In 1962 he was made an Associate of Honour of the R. H. S. Among his many publications are "Orchid Growing" (W. & G. Foyle, 1955) and "Orchids" (St. Martin's, 1963).

M. M. BRUBAKER is a retired chemist who was for many years in the research department of E. I. du Pont de Nemours & Company. He now calls himself the director of a "run-down 50-acre private arboretum" at Chadds Ford, Pennsylvania, where he also engages in orchid cultivation as a hobby.

FREDERICK W. CASE is a member of the Conservation Committee of the American Orchid Society. He is the author of "Orchids of the Western Great Lakes Region," published by the Cranbrook Institute of Science at Bloomfield Hills, Michigan, where he is a Research Associate and Life Fellow.

G. WALLACE DEKLE, Entomologist and Coccidologist, Division of Plant Industry at the Florida Department of Agriculture, Gainesville, is also Courtesy Professor, Department of Entomology, Institute of Food and Agricultural Sciences, University of Florida. He is a lecturer and specialist on Florida orchid insects and their control.

G. C. K. DUNSTERVILLE, retired head of Shell Oil Company in Venezuela, is an enthusiastic orchid hunter there. His exploration and research have led to the publication of four out of eight projected large volumes on "Venezuelan Orchids Illustrated" (Museum Books, Inc., 1959-66), prepared in collaboration with Leslie A. Garay and illustrated with his own detail drawings of every species. He is a Research Fellow in the Oakes Ames Orchid Herbarium at Harvard University, where Dr. Garay is Curator. Mr. Dunsterville is also the author of "Introduction to the World of Orchids" (Doubleday & Co., 1964).

MRS. TRUMAN GREEN, Tampa, Florida, holds a Master Certificate as an Accredited Flower Show Judge of the National Council of State Garden Clubs. She is also an American Orchid Society judge and was Schedule and Judges Chairman for the Fifth World Orchid Conference in 1966, where she won a gold medal for an arrangement.

APHRODITE J. HOFSOMMER, a retired physician in Menlo Park, California, has long grown orchids as a hobby. In 1961-62 she was a contributing editor of the *American Orchid Society Bulletin* and author of a series of articles on growing orchids under lights.

MERRITT W. HUNTINGTON is Vice-president and General Manager of Kensington Orchids, Inc., Kensington, Maryland. He is a trustee of the American Orchid Society and treasurer of the Eastern Orchid Congress.

H. PHILLIPS JESUP, Bristol, Connecticut, became interested in collecting orchids as a high school student on vacation in Jamaica, and, with his wife, has visited that island and the Bahamas many times since. Today the Jesup orchid collection is outstanding. A graduate of Lehigh University in Pennsylvania, Mr. Jesup is trust officer at the United Bank & Trust Company in Bristol.

SARAH STIFLER JESUP (Mrs. H. Phillips Jesup) is editor of the Greater New York Orchid Society's *Orchidata*. She collaborates with her husband as a lecturer, collector and grower of award-winning orchids. Two hybrids have been named after the Jesups.

JANET and LEE KUHN have recently transferred themselves from enthusiastic amateurs into the small hobby-business class, and are now running J & L Orchids at their country home in Pottstown, Pennsylvania. Mr. Kuhn is an executive with Firestone Plastics.

MARY NOBLE of Jacksonville, Florida, has been a hobby orchid grower since the late 1930's. She is the author of numerous horticultural articles (some of which have been reprinted in PLANTS & GARDENS) and of several books, among them "You Can Grow Orchids," privately published, now in its third edition. She is a trustee of the American Orchid Society and Chairman of its Public Relations committee.

REBECCA TYSON NORTHEN (Mrs. Henry Northen) of Laramie, Wyoming, started growing orchids about 1942 and in the early years raised them and her three children simultaneously. She is the author of "Orchids as House Plants" (Van Nostrand, 1955) and "Home Orchid Growing" (Van Nostrand, 2nd ed., 1962). She holds a Master's degree in zoology from Mt. Holyoke College.

(Concluded on page 81*—inside back cover)*

THE BROOKLYN BOTANIC GARDEN

Unique Christmas Gifts

Mark gifts desired and order well in advance. Make check payable to the Brooklyn Botanic Garden (and mail to the attention of Mrs. Norman Free) Brooklyn, New York 11225. Gifts marked by asterisks*, when purchased by residents of New York City, are subject to a tax of 5 cents for each dollar of goods ordered. Purchasers in New York State outside New York City add only 2 cents for each dollar of purchase. If any of the following gifts are to be mailed to others, please send your greeting card for us to enclose.

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(post paid)

***Gift #1** Offered for the first time are these exceptionally beautiful cards of the Botanic Garden's Japanese Garden, in full color. Choice of printed message, or blank. Be sure to designate (a), (b) or (c).

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(b) "May this Christmas bring you Happiness"

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Photographs of outstanding specimens in the Botanic Garden's famous Holsten and Phipps Bonsai Collections.

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SPECIAL BONSAI ITEMS— *(continued)*

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*** BONSAI NOTE PAPER $2.10**

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Two striking designs by a talented artist based on bonsai in the Botanic Garden's Collections. Box of 20 folded streets and envelopes (4" x 5½"). 10 printed in black and 10 in forest green. Just right for thank-you notes or gift cards.

***Gift #6** **HANDCRAFTED PAPER FROM JAPAN $6.00**

(Suitable for wrapping unusual Christmas Gifts) (post paid)

10 large sheets (24" x 40")—shades of yellow, green and silvery white; handcrafted from the bark of three woody plants growing mainly on the western slopes of Honshu Island *(Edgeworthia papyrifera; Broussonetia papyrifera;* and *Wikstroemia papyrifera).* The delicate colors are produced by bleaching, or by staining with natural plant dyes. A beautiful specimen of *Broussenetia* is grownig here in the Botanic Garden for visitors to see.

***Gift #7** **BONSAI, beautiful well-grown specimens, in imported Japanese containers . . . . $15. to $250.**

A limited number available, created and trained by an expert at the Botanic Garden. Specimens vary in artistry, size and kind of plant material; both evergreen and deciduous. Sales at the Garden only. Trees cannot be shipped. Please telephone for an appointment with Mrs. Free (212—622-4433)

Gift #8 **Handbook on DWARFED POTTED TREES, the BONSAI of Japan $1.25**

(Sent 1st class mail)

This 96 page handbook, printed on coated book paper is illustrated with more than 100 photographs and drawings. Now in its 12th printing, this Best Seller is the only low price bonsai classic available. Chapters by Japanese authors. Translated and edited by Kan Yashiroda.

Gift #9 **BONSAI: SPECIAL TECHNIQUES $1.50**

(Sent 1st class mail)

This 89 page book is a companion volume to the above, with more than 200 illustrations, 8 pages in full color. Translated and edited by Kan Yashiroda.

PLANTS & GARDENS

Published quarterly

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CONTENTS

Staff for this issue:

H. Phillips Jesup, Sarah Stifler Jesup and Carl L. Withner

Guest Editors

Carol H. Woodward, *Associate Editor*
and the Editorial Committee of the Brooklyn Botanic Garden
Frances A. Dämm, *Secretary of Publications*

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BROOKLYN BOTANIC GARDEN, BROOKLYN, N. Y. 11225

Copies of this and other issues of PLANTS & GARDENS are available as Handbooks. For a list of topics see back cover.

George Kline

A hanging garden of miniature orchids in a window. (See p. 57)

BROOKLYN BOTANIC GARDEN

ORCHIDS AS I SEE THEM—George S. Avery, Director of the Garden:

Here at the Garden we are growing nearly one thousand of the some 30,000 different species of orchids that are presently known. They are under the watchful eye of Dr. Carl L. Withner, Orchid Specialist, who has assembled most of the extensive collection—which also boasts a few hundred carefully chosen hybrids. Visitors who frequent the "Orchid Window" in our greenhouse range will have seen, from time to time, at least a few hundred of the total in the collection. Most of the species orchids are shy bloomers, so are on exhibit only at one season of the year. Dr. Withner has himself collected orchids in Brazil, Colombia, Ecuador, Mexico, Venezuela and Puerto Rico, and has observed orchids growing in the wild in many countries of the Far East. As this is written he is on a collecting expedition in the Dominican Republic.

G. C. K. Dunsterville, author of an article in this Handbook, visited the Botanic Garden recently—which is a good reminder to quote from his book. Says G.C.K.D.: "The orchid is a highly publicized but little known family of flowers, gaining its world wide reputation from less than one per cent of its members." And he goes on to point out that orchids of one kind or another range over the earth from the Equator to Greenland and from sea level to 14,000 feet above. Environment seems no barrier, for they grow in swamp, desert, forest and grasslands, on the ground and in water, as well as on trees and rocks. They can be small enough to grow in a thimble or long enough to climb a 100-foot tree.

In temperate regions of the earth, orchids grow like most other plants, with roots in the soil. Botanists seem to agree that in the evolution of orchids, these terrestrial forms are the most primitive. But over milleniums they have taken to the trees. In the tropics they are mostly epiphytes, that is, they grow upon trees without deriving nourishment from them. In these epiphytic species all parts of the plant can absorb moisture but there is a special sponge-like tissue on the outside of aerial roots that is especially adapted to taking moisture from the dew and rain. The only orchid that has made its way as an economic crop plant, valued for flavoring, is the vanilla vine, an epiphytic type.

For the newly interested amateur, orchid names are admittedly a hurdle. Only a few have colloquial names, so it remains for the neophyte to boldly master names of those that interest him and go on from there as time and interest dictate.

In the past seventy-five years both amateur and professional botanists have been busy collecting new species, and in that time span about 300 new genera and 20,000 new species have been described in the botanical literature. Little wonder that the orchid family competes with the composites (sunflowers, daisies and their kin) for the title of the largest family in the Plant Kingdom.

For the admirers of the pink lady's-slipper (*Cypripedium acaule*) it ought to be pointed out that plants are extremely difficult to transplant. There is evidence that they may live as long as fifteen years as young developing plants in the ground before the characteristic pair of green leaves emerges.

From the standpoint of the intricate and very special mechanisms that insure cross-pollination, orchids possess the most elaborate adaptation to insect pollination of the flowering plants. Most produce little clumps of pollen grains that are picked up by the nectar-seeking insect. The pollen adheres to the sticky stigma of the next flower-on-the-route and thus successful cross-pollination occurs. Bees are not the only pollinators; others include moths, flies, humming birds and bats. Seeds of most species are so minute that in nature the wind disperses them, and they may lodge in the bark of trees where, in tropical jungles, life starts anew.

It is a privilege to acknowledge the thoughtful service given by the Guest Editors and the authors they invited to contribute to this Handbook. To Sarah Stifler Jesup and her husband H. P. J.—along with Carl Withner, comes our special appreciation for sparking the Handbook into existence. Readers everywhere will be warmly grateful to the authors, each of whom is a highly knowledgeable orchidist in his own right. Other acknowledgments, including sources of illustrations, are made in appropriate places throughout the Handbook. Photos credited to Robert E. Hurwitz have been reproduced through the generosity of Kensington Orchids, Inc. In connection with color illustrations it is a pleasure to mention the orchid firm of Jones and Scully Inc., Dr. William W. Wilson of Philadelphia and the H. Harrison Conroy Company of New York.

The orchids that have found their way into the hobby world of the amateur are but a scattering few of the total in existence. The biblical phrase is appropriate here. . . . ". . . many are called, but few are chosen."

Robert E. Hurwitz

"Consider growing phalaenopsis for winter cheer."

BEGINNING WITH ORCHIDS

The plants will meet the novice halfway if their needs are understood

Mary Noble

SOMETIMES it takes courage to buy the first orchid plant; many people are timid about trying to grow orchids.

But once preliminary prejudices are overcome, the rest is easy. Those of us who were either brave or foolish when we began, now know that orchids are not difficult; they are tough, inexpensive and rewarding plants, and their flowers are the most fascinating of all.

Even those of us who live in regions where flowers bloom in our gardens all year round have our hibiscus only in the summer, our camellias only in winter, and our flowering dogwoods in the spring. But we can have orchids to enjoy every day in the year.

So can you, no matter where you live. With two dozen plants chosen for succession of bloom and durability, orchids will give you a display around the calendar. Each plant has its own time of flowering, but the collection as a whole need not be seasonal—though it can be if desired. You can choose orchids that all flower in winter when the garden is snowbound, or others to bloom in summer on the patio. For winter cheer consider paphiopedilum or phalaenopsis, and for outdoor summer décor, vanda, which likes sun and heat.

But I am getting ahead of myself. In the articles that follow you will find that many orchids inhabit places with distinct wet and dry seasons, and so have reserves of water and nutrients to tide them over the difficult periods. These same qualities help them to survive while you are learning to cope with their needs. Don't try to force the orchids to adjust to you. They will meet you more than halfway, but if you are beginning with these plants you must first adapt your point of view to their requirements.

Decide to make friends with these plants, to understand their needs, and to do your best to keep them thriving. Your problems will shrink to almost nothing once you comprehend what the plants want. When you decide that orchids are not like African-violets (they are less temperamental), not like roses (much less trouble), and not as shade-tolerant as

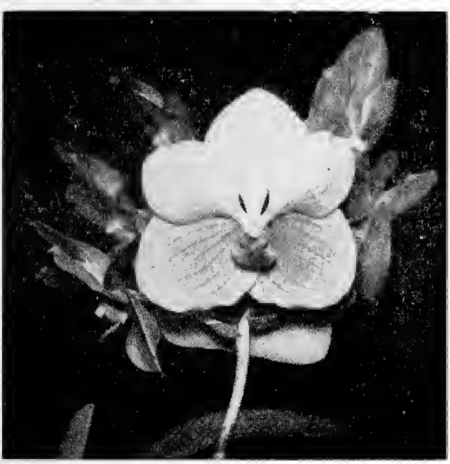
grandmother's Boston fern (but not needing full sun either), then you are off to a good start. Orchids are orchids. They are like no other plants, and therein lies much of their fascination. What is more, each orchid is different from the next one. Some like it cool, some like it hot; some grow fast and some grow slowly.

Few of the orchids we grow hail originally from densely shaded jungles. Most of them come from open sunny places, often bathed in mist from clouds or waterfalls. Some grow on rocks by the sea and others grow within sight of snow-capped mountains.

Many of the orchids you will acquire never saw a tropical country of any kind. They were raised from seeds sown in laboratories, nurtured on formulas in sterile bottles, and grown to maturity in greenhouses with automatic controls for temperature, humidity and light. But don't let this fact scare you, either, for the same plants may do just as well in the irregular routine of your small greenhouse, windowsill or lighted cart.

The potential cost of orchids frightens many hobby gardeners. True, high prices can be paid for rare plants or those of special quality, but when you are beginning you want sturdy, healthy plants, not costly rare types.

How will you begin with orchids?



Mary Noble

Excellent for outdoor bloom in summer is *Vanda* Tom Ritter 'Evelyn' AM/AOS.

Robert L. Nay

Small-flowered species of orchids ("botanicals") such as *Pleurothallis quadrifida* from tropical America, have become popular among home growers.

First, go sightseeing. You can do this at nurseries, which exist in many states, at botanical and show gardens in many cities, and at orchid shows, which are held all over the country. Principal show dates are listed in garden magazines and major newspapers. Check for those near you. If you are planning a vacation, write to the American Orchid Society (c/o Botanical Museum of Harvard University, Cambridge, Mass. 02138) for a current listing of show dates. Florida and California have the greatest number of shows, but you will be amazed at the number held in cities and suburban centers around the country.

At either shows or nurseries, look first at the major types of orchids and learn to distinguish them. If you observe carefully you will soon be able to distinguish a flower of the cattleya alliance, the big purple corsage orchids, and you will see that they are not all purple, large, or monochromatic. Distinguish next the cymbidiums, also familiar corsage flowers with long spikes and blooms in charming pastel shades. Then there are the phalaenopsis orchids, generally white and often seen in bouquets and corsages; but you will see some with pink pepper-

Ted Dully

Many orchids are as fascinating for their fragrance as for their unusual growth habits; *Cattleya citrina*, always pendulous, combines both features.

mint stripes, some yellow and brown like tigers, some with spots.

That's not all. You will be bewitched by miniatures that are perfection beneath a magnifying glass; also by curious blooms that look more like spiders, birds or pop art tnan like flowers. If you have never been to an orchid show, you will be amazed.

After you make the acquaintance of the general types (to help you identify these, the A.O.S. has a little brochure which is available free at most shows), jot down the names of the ones you like the best. Not the finest ones with the biggest pieces of silver and the bluest ribbons, but the general types. Shop at the show, at a nursery, or from catalogs of reputable dealers for blooming-size plants of the types you want.

Whenever you buy a plant, ask the nurseryman for the cultural directions. Many orchids can live together in the same conditions, but each one is a bit different, even from its relatives, and some of them cannot survive in the same environment. Other articles in this handbook will guide you to the types of orchids you can grow in the location you have to offer. If you learn that your situation will not satisfy certain orchids you would like to have, you can easily analyze your conditions and select plants that will enjoy the environment you can provide.

Beware of great bargains—avoid any ad that makes fancy claims and states prices much below the going rates. Select blooming-size plants, preferably in flower, so you will know exactly what you are getting. Seedlings of orchids, like babies of any type, are more tender and need more care than adults. Besides, your patience may not hold out for the two, three or maybe five years before the seedlings are big enough to bloom. You will feel encouraged if you have flowers from the start.

If there is someone in your neighborhood who grows orchids as a hobby or has a small orchid business, plan a visit but first telephone for an appointment. I love to have people visit me, but not when I'm racing toward a newspaper deadline or am washing flowerpots in the garage. If you are traveling, phone ahead to orchid nurseries and don't arrive at lunchtime, closing time, or on Sunday when they are not open. You will do yourself a favor if you plan your arrival when someone on the staff can spend time with you discussing the plants.

Then there are the local orchid societies, over 136 in 36 states, and probably one near you. Most of them meet every month. Write to the A.O.S. for the name of the one nearest you. Contact the president and ask if you may visit. Some of these groups limit membership by invitation, but if you are genuinely interested, chances are you will be more than welcome.

Besides offering an instructive program, orchid society meetings usually have a plant table where members show blooming specimens. Even the oldtimers often see something new and different, because if you live to be 100 you will never see all the orchids. There is a population explosion among orchids, too, and there are thousands of new hybrids coming on all the time.

When you acquire a few plants you will want to increase your knowledge. To

do this, join the American Orchid Society, which has 11,000 members all over the world. Most of them are amateurs, many are rank beginners, while some are experts with long experience. These people meet monthly through the 96-page *AOS Bulletin,* much of which is written by and for home growers. Then there are all those enticing ads that will help you add to your collection of plants. Space, money, time are the only limitations.

Orchids take time, of course. You have to water, fertilize, repot, and also control the pests, but the rewards are great. It is thrilling to me, even after all these years, to spot a new root pushing into the compost; to see a leaf develop; to watch a flower bud change from green to another color, to see it unfold into an enchanting bloom, and then to enjoy and marvel at it every day for a week, perhaps even a month. Orchids can change your life.

You will never be blasé about your orchids. You will rush to your greenhouse or plant cart the first thing every morning to see what has happened overnight. You will schedule your working day to allow more time for the orchids, and your vacation in order to attend orchid shows. ♦

Ted Dully

"Perfection through a magnifying glass." This miniature orchid (*Oncidium henekenii*) so closely resembles a certain insect that flowers are sought for mating.

Robert E. Hurwitz

Cymbidium is a familiar corsage flower that requires coolness over winter. The mericlone illustrated is *Cymbidium* Kurun 'Troubadour'.

WHAT IS AN ORCHID?

Carl L. Withner

HOW many times have people asked me if an iris isn't some kind of orchid? No. Orchids are not lilies, amaryllids, gingers, cannas, bananas or irises, but all are closely related. These families are grouped together to form the monocots of the botanical world, and the orchids are noteworthy for having the most specialized flowers, habits and life histories in the entire group.

Flower Characteristics

The major distinction of the orchid flower is the *column,* the single reproductive structure formed by a fusion of stamens and pistils that are separate in the flowers of the other families mentioned above. Though there are basically three stamens and three pistils, usually only the anther of one stamen remains functional, bearing its pollen at the tip of the column. The stigmatic surface, the part of the column that receives the pollen, is just below it.

The orchid flower has three sepals, alternating with three petals. The sepals protect the flower in the bud, but become colored and petal-like when the flower opens, often giving the impression of a six-petaled flower, or five petals plus one that is different. The different petal (and one always is) is called the *lip.* The lip petal is marked by unusual form, veining patterns and usually a series of keels and protuberances called a *callus.* The shape of the lip and its callus—sometimes the whole flower—is highly adapted for insect attraction with resulting pollination. In fact, the evolution of the orchid family closely parallels the evolution of pollinating insects.

Fruits and Seeds

If pollination takes place, a seed pod forms that may require as long as 14 months to develop. Usually about nine months will suffice, and the pod may have literally millions of seeds in it. The seeds are almost dust-like in size and are easily carried by wind and water for great distances. The embryo of the orchid seed is so tiny and underdeveloped, in comparison with other types of seed, that special conditions are necessary for its germination and growth (see the article by Joseph Arditti). Until the little ball of undifferentiated cells becomes green, forms a growing point and finally begins to develop tiny leaves, it must live in symbiotic assocation with a favorable fungus. It is not surprising that from the many seeds produced in a single pod only a few survive to grow to adulthood—a process that may occur in a few months but with most species takes from six to twelve years.

Orchid Evolution

Orchids most likely originated in the warm regions of southeastern Asia and spread from there throughout the world. While the majority remained in the tropics, others, in migrating, became adapted to colder climates by means of seasonal growth that responds to changes in temperature. In the tropics, some orchids can grow more or less continuously, but most are seasonal there, too, responding not to winter *vs.* summer, but to the effects of alternating wet and dry periods. Such factors must be considered in the culture of these plants.

Growth Patterns

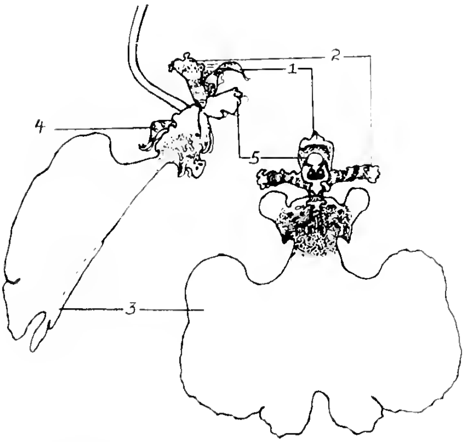
The orchid plant itself has a variety of forms that merge into three basic patterns, one terrestrial, the other two epiphytic (*epi*=upon; *phyton*=plant). Terrestrial orchids in both tropical and temperate zones form leaves and flower stalks from underground corms or rhizomes that enable the plant to winter over. In fact, the name orchid is from the Greek *orchis,* meaning testis, in reference to the appearance of these underground parts. Theophrastus, Dioscorides, and other ancients of Europe and Asia Minor were

DIVERSITY IN DESIGN

Some examples of orchid flowers of distinctive form

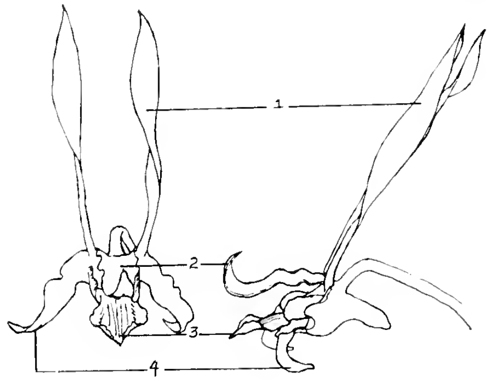
Key to the drawings: 1—dorsal sepal; 2—petal; 3—lip; 4—lateral sepals; 5—column.

Drawings by Sydney Kenna



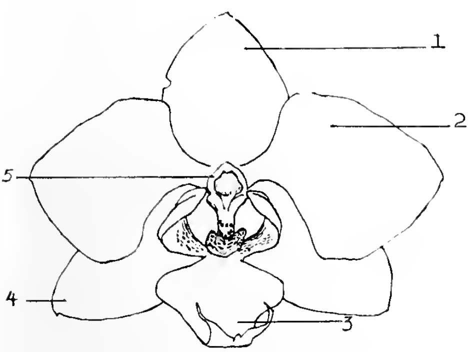
Oncidium Java

Note the heavy callus (the dotted portion, indicating tubercles) on the lip; also the tremendous size of the lip in relation to the rest of the flower.



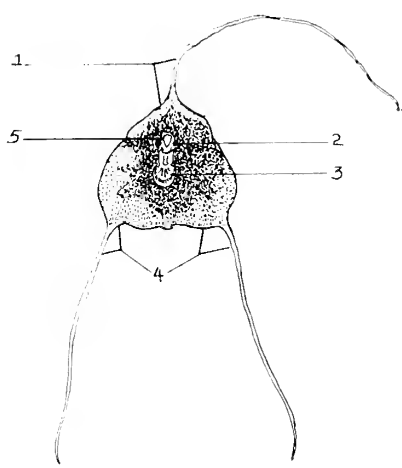
Dendrobium d'albertisii

Here the column is hidden. Petals are elongated. Keels replace the usual tubercles of the callus on the lip. The two lateral sepals form a spur at the base.



Phalaenopsis

In this typical hybrid, the lip is markedly three-lobed, with two short threadlike tips on the mid-lobe. Sepals and petals are similar in size.



Masdevallia erythrochaete

Note that the combined sepals form a broad-mouthed tube with three long tails. Petals and lip are in the center, greatly reduced in their dimensions.

Peter K. Nelson

Chinese scroll with orchid and bamboo painted at the base and a separate clump of orchids at the top. The "upright" is a representation of a rock. Translation: "Painted after [the style of an 18th Century] artist Chêng." From the scroll collection of Carl L. Withner. Interpretation by Mr. Fong Chow, Metropolitan Museum of Art.

the first to describe such orchids. In those days people were interested in the presumed medicinal uses of plants and whether or not they had souls, and thought that the shape or structure of a plant "told" what it was good for.

In the tropics, the habit of most orchids is to perch on the branches of trees, or sometimes rocks, from which they derive support but nothing else—they are *not* parasites. If the orchid grows constantly from the tip, and propagates itself by forming offshoots (known as "keikis" from their Hawaiian name) from the base of the plant, we refer to the growth pattern as *monopodial* (single-footed). Monopodial orchids are found especially in the forests of southeastern Asia, the Philippines, Madagascar (Malagasy) and Africa. If the plants grow seasonally, responding to wet and dry periods, sending up a new branch each season from the main rhizome, they are considered *sympodial* (with feet). Such orchids are found especially in the New World, but also where the monopodial types grow. (For more detail, see John Blowers' article on page 12.)

Learning to grow orchids in cultivation and to recognize the different sorts are

(*Concluded on page* 78)

The orchid species shown below and portrayed in the scroll at the left is *Cymbidium ensifolium.*

Peter K. Nelson

WHAT'S IN A NAME?

Sarah Stifler Jesup

ORCHID names are not as hard to pronounce and remember as they look at first glance. As they always follow established international rules, spending a short time studying their construction will help even the most casual grower.

Here is a typical species designation: *Cattleya dowiana*. *Cattleya* is the name of the genus (in honor of a Mr. Cattley), *dowiana* the name of the particular species within that genus. Although in this case the specific designation honors a Captain Dow, many specific names refer to characteristics of the plant which may be a help to the grower in relating the plant to its name (*Ex.:* the scent of *Epidendrum fragrans* is unforgettably strong). At times a population of a species will be found which differs slightly but consistently from the typical form. This could qualify for a varietal name, such as *Cattleya dowiana* var. *aurea*.

For a newcomer to orchids, italics will be of great help. Note that generic, specific and varietal names are properly italicized, and that specific and varietal names do not begin with a capital.

So far, the names we have considered are for orchids as they have evolved in nature. Along comes man with his hybridizing toothpick and crosses *Cattleya dowiana* with *Laelia flava*. When a new hybrid blooms he is entitled to give it a name of his choice and register it with the orchid registry operated by the Royal Horticultural Society, Vincent Square, London, S. W. 1. Unless the hybrid combines genera not previously crossed, the hybrid generic name will have been established by the registry, but the hybridizer (or the owner of the plant if it has been sold or given away) may pick a name for the cross, which is known in botanical circles as the "grex" designation. In our illustration a check of the registry showed that the hybrid generic name had been established as *Laeliocattleya* in 1863, and the specific cross of *Laelia flava* × *Cattleya dowiana* was registered as *Laeliocattleya* Andromeda in 1904.

Note that you can immediately tell a grex name (indicating a hybrid) from a natural species as the grex name is not italicized and must begin with a capital letter. Unlike many other cultivated plants, the grex designation in orchids, *i.e.* Andromeda in our example, applies to all seedlings from the cross, or from subsequent crosses having the same species or hybrids as parents.

An optional part of an orchid name is a clonal epithet to identify a single clone (an individual plant and all that arise from it by vegetative propagation). In orchids, a clonal epithet almost always indicates the plant has been given an award, but this is a matter of practice rather than rule, as anyone may give a plant such a name for identification. The epithet is in single quotation marks and roman type and begins with a capital letter. The name of an award should always appear with the name of the orchid; it is indicated by initials placed after clonal epithet (*Ex.: Laeliocattleya* Andromeda 'Golden Gem' FCC/AOS). The initials stand for "First Class Certificate, American Orchid Society."

Another abbreviation frequently seen is of generic names. *C.* standing for *Cattleya* or *Lc.* standing for *Laeliocattleya* will only occur (properly) in a listing where the full generic name has earlier been given (*Ex.: Laeliocattleya* Andromeda, *Lc.* Bold Warrior, etc.).

Understanding of the Latin and Greek endings of botanical names will come with time. Once you know a few genera you will find it easy to see that specific names modify generic ones (*Ex.: Epidendrum cochleatum; Vanda sanderiana*). Some novice horticulturists (and stubborn experienced growers) complain

(*Concluded on page* 28)

GROWTH HABITS AND PROPAGATION

Different means of increase used for the two basic types of orchids

Illustrated with the author's photographs from his book "Pictorial Orchid Growing" (privately published, in England, in 1966).

John W. Blowers

Paphiopedilum (Cypripedium) Hellas 'Westonbirt' shows the habit of a sympodial orchid.

ORCHIDS are perhaps best known for their great diversity of floral forms, from a midget flower requiring a hand lens to become familiar with its features, through a range of different sizes to a mammoth bloom about 8 inches wide. Equally diverse and a source of endless interest are the plant forms, fascinating because each shape or growth habit is a clue to culture and/or propagation. To give some idea of the variety of growth habits I mention the smallest—*Bulbophyllum minutissimum*—of pinhead size, and then the largest of all—*Grammatophyllum speciosum*—a fine example of the latter was seen at the Fourth World Orchid Conference, Singapore, 1963: a specimen 8 feet tall occupying some 30 square feet shown by the Sultan of Johore. The majority of orchids are intermediate within this size range. Since most countries have native orchids, growth habits and plant construction are equally diverse to cope with the wide assortment of climates and seasons.

Most people tend to believe that orchid plants are delicate, as a consequence difficult to manage and propagate, and also short lived. The opposite is the truth. Orchids are generally tough in construction and they continue their growth from year to year. To my knowledge there are plants in England that date back 90 years or more. Orchids are a wonderful value, especially as in a few years they provide propagations for exchange or sale.

From the point of view of growth habit, orchids are separated into two distinct, easily recognized groups: *sympodial*, whose members grow from lateral buds on the base of the pseudobulb of the parent plant, and *monopodial*, whose stems increase in one direction only by apical growth.

Sympodial Orchids

Vastly greater in number and variability is the group of orchids with sympodial habits—that is, with several "feet" instead of a single growing point. Sympodial orchids continue life through basal buds that produce a duplication of the previous growth. This will be larger or smaller, depending on culture. Many of the popular orchids—cattleyas, cymbidiums, odontoglossums, paphiopedilums

Cattleya skinneri is a typical sympodial orchid, with successive new growths continuously arising from the base.

Propagation of a cymbidium by division. The plant was separated into two parts which were potted individually.

(cypripediums), epidendrums, dendrobiums—are in this category. Their vegetative growths display many different forms. They are connected by a more or less horizontal part of the plant, the rhizome, which varies in length according to species. As the growth matures, in some species the lower part of the stem swells for water and food storage. This thickened structure is known as a pseudobulb. It is important to think of it not as an underground bulb (like a narcissus or tulip), but an enlarged portion of the green stem. The stems or pseudobulbs bear leaves of different shapes and sizes. Some sympodial orchids shed their leaves, many are evergreen, others are intermediate. The majority of sympodials produce new growths each year; at their proper time they bear flowers and then, through storage and photosynthesis, they adopt a supporting role for continuation of growth. When pseudobulbs have about four or more years' service to their credit their efficiency diminishes. They then become *back bulbs* which provide an easy means of propagation.

Propagating Sympodials

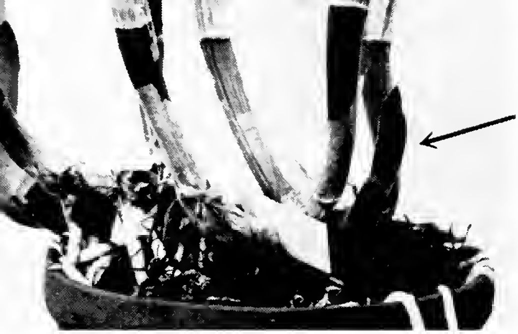
Since reproduction of specific orchid clones to make genetically identical plants is not possible from seed, vegetative propagations are necessary. Until recently this was a slow but easy business, slow

A cymbidium back bulb removed and potted up individually.

because a "green thumber" could raise only two or three propagations of a single clone in five or six years. Now thousands of plants may be raised in a few months (to seedling size) through the meristem tissue method of propagation.* Old methods, however, retain their value and importance. Hobbyists may require only two or three duplications—not thousands—of a particular variety. The new method, moreover, is not within the scope of many growers, since special laboratory equipment and techniques are essential.

Well-nurtured into strong plants, most sympodials develop more than one new growth or pseudobulb from the previous one. In a season they can branch in different directions, a habit common to many kinds of plants; these growths are known as *leads*. In time, when each branch or lead has two to ten pseudobulbs, it may be separated from the main

*See page 58.



Above: A cattleya propagation. A cut made part way through the rhizome (note plant label inserted in the cut) stimulates new growth (arrowed) from one of the back bulbs. The two parts will be separated when the plant is repotted. *Right:* A typical cattleya back bulb propagation.

plant and, as a division or piece, given a separate existence.

At the base of each pseudobulb or back bulb are dormant growth buds or *eyes*. At the time back bulbs are separated from the plant (generally when repotting), simple treatment will entice these buds into growth that will provide propagations. The size and number of back bulbs to each propagation will determine the time in years from propagation to flowering. If they are extra large back bulbs, as in cymbidiums, they may be given individual treatment for blossoming in two to four years. Species or hybrids with small back bulbs are best retained in groups of two or three bulbs to produce a strong propagation and to reduce the time to flowering.

Often advantageously, back bulbs may be encouraged into propagative growth before they are separated from the plants. At the beginning of a year the rhizome is nicked or cut part way through at the appropriate point, so that for a time the back bulbs have partial support from the main plant. When growths and roots are produced by one of the back bulbs the rhizome is cut through and the propagation treated as a division.

Some kinds of orchids are easier to propagate than others. The younger the back bulbs, the better are the chances of success. Some types are extremely generous in producing *adventitious growths* or *bulblets* from their pseudobulbs; these are removed and treated in the same manner as monopodial offshoots (see below). Such growths may also be produced by the flower stems of some orchids (phaius and phalaenopsis), or they may be encouraged by cutting a flower stem into short pieces to be laid horizontally on a sandy peat mixture or vermiculite and held until they produce growths.

The treatment of back bulbs and other propagations is similar to the requirements of most plants being so propagated. For a time, increased warmth, humidity and shade are assets, such as are provided in a propagating frame with a growing base of vermiculite, or a sand and sphagnum peat mixture. Polyethylene bags are excellent in providing similar conditions. When back bulbs or other propagations are noticed to have roots they are repotted in the usual manner.

Monopodial Orchids

The second group, numerically lesser of the two, is designated as monopodial (single-footed). This type normally grows at the tip. Though lateral buds are present on the main stem, they develop into branches only when the plant has attained sufficient size and strength to

Tip of a vanda, a monopodial orchid, removed and potted as a propagation.

support them. In accordance with the habit of the main stem, each branch continues to grow indefinitely at the tip. These latent buds are important to the propagator of monopodial orchids. Their growth can, in fact, be induced by excision of the tip of the main stem.

Inflorescences of the monopodials emanate from the axils of the leaves or opposite to them. The leaves are *distichous*—that is, they are arranged in two rows or ranks. *Internodes,* the stem spaces between leaves, are extremely variable. In some species they are very short, less than an inch, and in others several inches distant. Popular monopodial orchids are vandas, phalaenopsis, aërangis, renantheras, angraecums, aërides and rhynchostylis.

Obviously, epiphytic plants which extend in length indefinitely need a strong attachment to the surface on which they are growing. This is provided by thick aerial roots (epiphytic orchids have no permanent main roots) which hold the plant in place and also absorb water and nourishment. These adventitious roots are covered with a special whitish layer of dead cells called the *velamen* layer, which soaks up moisture for the plant.

The tip of this monopodial orchid (a vanda) was removed for propagation four years previous to this photograph. Meanwhile, side shoots or keikis have developed and sent out roots. Such shoots may be removed to start new plants.

Propagation of Monopodials

Given the right cultural treatment to encourage strong plants, many kinds of monopodials—vandas and other—oblige by producing lateral growths referred to as *side shoots* or *keikis* (their Hawaiian name). Alternatively, a grower may force a plant in this direction by removing the top part, or *apex,* which then itself becomes a propagation. In time, latent lateral buds at various points along the monopodial stem are awakened; these side shoots will eventually bear roots, and when of sufficient size the shoots can be made independent of the main plant simply by removal with a sharp knife. They then become propagations, are repotted in the normal manner, and are encouraged with routine cultivation. ♦

For additional illustrations of methods used in orchid propagation, see page 16.

Back bulb propagation of *Zygopetalum crinitum*. Ideally, this should have been potted earlier, before the roots were of such great length and therefore prone to damage.

Back bulbs of odontoglossums are set up in trays of peat and sand, then placed in a propagating frame. Several have already started their new growths.

Polyethylene bags are excellent for starting sympodial back bulbs into growth.

Paphiopedilums (cypripediums), although without pseudobulbs, are propagated in the same manner as other sympodial orchids. Note the small growth bud at the base of this back growth.

GREENHOUSE ORCHID CULTURE

Temperature, light and humidity need to be kept in careful balance

Don Richardson

MOST orchid plants are rugged and can stand more abuse than other plants. They are killed more often by kindness than by neglect. Nevertheless, an understanding of their requirements is the first step in securing the ultimate in growth and bloom from orchids. The three essentials of culture—an ideal *temperature*, the correct amount of *light* and sufficient *humidity*— should always be kept in balance. To achieve these conditions, especially in the northeastern United States, a greenhouse is ideal. Since orchids from many parts of the world and from somewhat diverse ecological situations may be growing together, perfection may not be reached in every situation, but one can have fun and enjoy unusual flowers with only a little effort.

We are dealing here with orchids from tropical climates, the large majority of which are epiphytes (that is, they grow on trees or sometimes on rocks rather than in soil, as do our native hardy orchids). These tropical plants grow under a wide range of conditions in their native habitats, from sea level to 12,000 and 14,000 feet, under almost desert conditions, in cloud forests and tropical rain forests, and on cool, wind-swept mountains. To grow a widely varied collection efficiently, a greenhouse should have three compartments, each with a different temperature range. In each compartment there may be variations in temperature, light and humidity. It is these microclimates that make it possible to grow orchids from New Guinea in company with others from Burma, Peru, Borneo, Australia and Africa.

Should the grower wish to specialize in one genus, such as the showy cattleya or the popular cymbidium, his requirements are more simple and a one-temperature house will do. Even in such a greenhouse there may be areas with varying degrees of the three basic requirements which will suit a certain number of other types.

The site for a greenhouse should be free of heavy shade from trees. It is best to run the house from north to south, but we often have to make concessions and accept existing premises with whatever they have to offer. Since a whole issue of PLANTS & GARDENS* was devoted to the various types of greenhouses, their construction, operation and appurtenances, we will assume that the greenhouse is built and that you now wish to grow orchids.

We shall start with the three-compartment house.

Robert E. Hurwitz

Miltonias are good candidates for the coolhouse. This one is *Miltonia* Petunia 'Red Admiral' AM/RHS.

*Vol. 19, No. 2, Summer 1963. Handbook 42.

Ted Dully

Miniature species such as this pleurothallis from Brazil give much bloom in little space in a crowded coolhouse.

The Cool Section

The cool section where we can grow orchids from the higher altitudes should have a temperature range of 50 to 70 degrees Fahrenheit; a minimum of 45 degrees night temperature will do no harm in winter. It will be impossible in New York or Washington summers to maintain a 70-degree maximum, but with the help of evaporative coolers we can set the maximum temperature at 80 degrees in hot weather when outside temperatures are over 90 degrees. In very humid weather the coolers are less effective. This section would probably be the most expensive to maintain, but we would be rewarded by such wonders as the beautiful odontoglossums, denizens of the Andes of Colombia, Peru and Ecuador. The range of color and form in the hundreds of hybrid forms makes these most desirable. With them, in a smallish cool section, can be grown some of the dendrobiums from higher elevations in the Himalayas, a few miltonias, a few cymbidiums, a few oncidiums, and some laelias. The beginner in the orchid world should approach the high-altitude plants with caution; rather, let him experiment first with the intermediate section, where a much larger variety can be grown without special cooling devices.

The Intermediate House

In the intermediate house a minimum night temperature of 58 degrees should be aimed for and ventilation given when the temperature rises above 70 degrees, always remembering that the balance among the three essentials must be maintained. For instance, if vents are opened wide on a clear, sunny day, much humidity will be lost. The modern greenhouse combines vent controls, humidifying sprays governed by humidistats, and thermostatic heat controls to make a fully automatic greenhouse. These controls pay off when it is necessary for the owner to be away all day. Otherwise, manual damping down, wetting floors and walls several times a day in summer, must be done to come near the desired 60- to 70-degree relative humidity.

For most orchids some sort of shade must be provided from the end of February until November. The simplest kind is a liquid shading compound sprayed or painted on the glass. Better still, but more expensive, is Saran cloth stretched above the glass on some form of support. Best of all, but most expensive, are roller lath shades mounted 6 inches or so above the glass to leave an insulating air layer. These can be rolled up on dull, rainy days. They can be automatically raised and lowered by an electric eye, but it is doubtful if this is worth the extra expense, especially in areas where prolonged cloudy weather is not too prevalent. In greenhouses of plastic fiberglass, which gives diffused light, far less attention to shading is needed for all but the most shade-loving genera such as paphiopedilum (cypripedium), phalaenopsis or masdevallia. In winter, a layer of polyethylene, preferably tacked inside the greenhouse, will cut drafts and save fuel.

The cattleyas, most of the dendrobiums, laelias, many paphiopedilums or "lady slipper" orchids, most of the "danc-

ing dolls" or oncidiums, the miniature cymbidiums, and a host of interesting orchid species can be grown in the intermediate section. If we can find a warmer end we might try phalaenopsis and some vandas. The selection is tremendous, and the beginner should be advised to visit botanical gardens, orchid nurseries, orchid societies and friends who grow orchids, not forgetting flower shows, to select the types of orchids he wishes to grow. Other growers are always willing to help and often have a plant or two to spare for the new grower.

The Warm Section

The third section, known as the "stove" or warm section, should have a minimum night temperature of about 65 degrees Fahrenheit, which would naturally demand more fuel and incur more expense. Where greater shade can be given, phalaenopsis (the lovely "moth orchid" with arching sprays of white, lavender-pink and now yellow) can be grown, and the flowers are long lasting. Many dendrobiums love lots of heat while growing, but need a cooler place for a rest in winter to induce flowering. Vandas in all sizes and many colors and forms will flourish in this section if they receive good strong light. They will grow in shade, but seldom flower there. Paphiopedilums with tesselated or mottled foliage love the warmth, but would require shade and more water.

General Directions

Now a few rules, or rather suggestions, for general culture in the greenhouse. Epiphytic orchids have roots which must breathe; in their native habitats they can be subjected to heavy rains sometimes several times a day, but the rains are followed by sunshine and drying. We can simulate these conditions by attaching or mounting the orchids on logs, cork bark, or slabs of tree fern fiber. This is good where one has the time to spray or mist them frequently on hot sunny days. Where less attention can be given they would be better potted in clay pots with one of the open bark mixtures. (*Example*: 7 parts fir bark, 1 part poultry grade sphagnum peat moss, 1 part redwood fiber, plus a small amount of ground limestone.) Since this is a job to mix, the small grower would do better to purchase the potting material ready-mixed. The material is easy to use in a moistened condition, and a few taps on the bench and pressing with the thumb will usually make it firm enough. It will be necessary to feed frequently with a 30-10-10 soluble fertilizer, and the easiest way is to use a proportioner, of which there are several on the market. For a few plants, a regular fertilizer at one-fourth to one-half strength given with every other watering should be sufficient.

Robert E. Hurwitz

Dendrobium phalaenopsis, famous as the "Cookstown orchid," is the progenitor of a line of hybrids that do well in the intermediate house.

For many years, osmunda fiber, consisting of the roots of cinnamon, interrupted or royal fern, was the standard potting material. It contains all the essential food that an orchid needs so that supplementary feeding is not necessary. This material, sometimes called "orchid peat," lasts for two years in good condi-

Robert E. Hurwitz

Paphiopedilum bellatulum, a mottle-leaved species, thrives with heat.

tion, but correct use requires skill and practice. Much more drainage material should be used with plants potted in this fiber. First enlarge the drainage hole by chipping with a hammer, then place crocks (broken flower pots), preferably set on edge, to fill half to two-thirds of the pot. It is better to have a few lessons from a qualified person in the actual potting and then some practice on old or inexpensive plants when using fiber. Orchids such as vandas love to have their roots outside the pots or containers; in fact, it is almost impossible to keep them in. They do well in the largest size of fir bark chunks, these loosely placed around the roots. Cattleyas need very firm potting in fiber, but do well in the bark mixes. Dendrobiums should have the smallest size pot possible, while robust-growing cymbidiums will need 12-inch pots or even tubs, and will not need so much drainage material.

As with the first three necessarily balanced essentials (temperature, light and humidity), we must also achieve a balance in potting and watering. A plant in a tiny pot will dry out much faster than a plant in a large pot. The tiny plant, depending on material and drainage, may need water once a day in good weather, while the 8-inch pot can go for a week or more. In winter many orchids require a dry rest, often in cooler temperatures. Only by understanding a plant's cultural necessities can we make it happy. I have found that watering is the hardest thing to learn; it is more a sense of understanding, once the individual plant's requirements are known. It may be necessary to pester your favorite orchid grower or botanical garden for information. By all means, read everything you can, and ask what you do not understand. Then it will not be long before you can sense that a plant needs more water or less, more light or more shade. As a general rule, the more light we give without damage to plant tissues, the more flowers the plant will have.

Seedlings and plants in active growth require more shade than plants that have completed their year's growth. More light, then, may safely be given in October than in early spring. Terete-leaved vandas, many cymbidiums, some dendrobiums will not flower without good strong light.

Remember, many orchids grow in the upper branches of high trees and love a fresh and buoyant air. We can help in the greenhouse by the use of top and bottom ventilators when temperatures and other conditions permit. Fans strategically placed will help to keep the air moving and so avoid stagnant areas which breed disease.

Good clean housekeeping in the greenhouse helps to keep down pests and diseases. A periodic spraying with Malathion plus a wetting agent will control most insect pests. Slugit sprayed on walls, under benches and floors and on pots will keep the house free of slugs. It is well to follow up a spraying in another ten days to be sure you catch the second hatch. Orchids are much easier to keep clean than chrysanthemums or snapdragons.

These suggestions have of necessity been very sketchy. If, when the beginner visits other orchid growers, orchid nurseries, orchid societies or botanical gardens, information conflicts, he should feel assured that before long he will be able to evaluate it—by which time he will no longer be a beginner.

PITFALLS FOR THE BEGINNER

Some common cultural mistakes and how to avoid or overcome them

M. M. Brubaker

CONSIDERING the ruggedness of the commonly grown orchids and the conditions tolerated in nature, such as long periods of drought, torrential rains, tropical sun, and almost nothing in the way of nourishment, one wonders why there should be any difficulty in growing them. Some of the difficulty may be psychological. The delicate and intricate appearance of the flowers and the awe that surrounds this family of plants leads the beginner to think that their growth must require meticulous skill. A little study of their peculiarities and attention to a few details are all that are needed to grow some of the showiest orchids. It is mainly a matter of "bother," and I am listing below some things worth bothering about.

Watering

For the beginner, the most difficult aspect of orchid growing is watering. To understand this, one must appreciate the difficult transition, for the epiphytic orchid, from the tree limb, where the roots are constantly exposed to fresh air, to the greenhouse pot. The roots must have fresh air even if drying of the surrounding material is necessary to let it in. There is consequently a close relation between the potting medium and the watering technique. A change in the potting medium usually requires altered watering practice.

Beginners are inclined to make rather impulsive changes in the potting medium. A great variety of media have been successfully used. The British grew magnificent orchids for more than half a century in mostly peat and sphagnum moss. Media as different as lumps of fir bark, fern root, coconut husks, and gravel are used today, and each requires a different watering practice. It is best to stay with a selected potting medium until proper watering has been learned, and then make any change cautiously.

Beginners often start with cattleya-type orchids, and watering too frequently, without allowing the roots to become well aerated, is their most common mistake. Well established orchids in proportionately small pots and in active growth can be watered more frequently. Plants with much reduced or no roots prefer frequent misting of the foliage.

As the potting medium ages and breaks down, watering becomes a much more critical matter. Often the beginner is found struggling with a gift orchid that needs repotting in fresh medium rather than skill in watering. With cattleya-type orchids and many others, light-colored roots "crawling" on top or near the surface of the medium, and plump front bulbs indicate proper watering.

A corollary mistake of beginners, when they realize they are overwatering, is to cut down on the amount of water rather than the frequency of watering. This can lead to an accumulation of salts from evaporation of water and from fertilizer residue. Orchids need to be drenched periodically to leach out any accumulated salts, then allowed to dry out before being watered again.

Problems in Potting

It is a frequent mistake of beginners to change the nature of the potting medium without cleaning out the kind previously used. A particularly objectionable situation arises when a plant grown in osmunda is given a roomier pot in which fir bark is used to surround the old root ball. A fir bark watering practice will then surely rot the roots that are left in os-

munda. The old osmunda should all be picked out before repotting in bark, no matter how tedious the job seems.

"Potting on," or surrounding the old root ball with fresh potting medium, is an acceptable practice if the old potting material is of a durable type and in good condition, and if the same kind is used. With fir bark, "potting on" is generally undesirable.

Failure to Bloom

Failure to bloom in healthy-looking orchid plants is most often the result of too little light. There seems to be a misconception that orchids enjoy the gloom beneath dense vegetation. On the contrary, many cattleyas, laelias, dendrobiums, oncidiums, vandas, and epidendrums flower most abundantly when they receive sunlight for at least part of the day. When grown in heavy shade, these plants have dark green leaves and do look better. However, the leaves which grew up in the shade will blacken when exposed to high light, furthering the misconception that orchids resent strong light. It can be somewhat of a task to accustom a shade-grown plant to the high light necessary for abundant bloom.

Let There Be Rest

It is often essential to rest orchids for good bloom or for proper growth. Some of the commonly grown orchids do not need a real rest, although they have periods of less active growth when they should have less frequent watering. Ignoring or slighting a rest period does become a pitfall when the beginner grows such orchids as dendrobiums, catasetums, cycnoches, and some oncidiums and odontoglossums.

Many dendrobiums must have a comparatively long rest period with very dry or cool conditions to initiate flower buds. Often the novice cannot bear to give his plants drastic enough conditions to obtain good flowering.

Cycnoches grow very actively in summer and require heavy watering. They then flower and rest. The bulbs are inclined to rot unless they are carefully dried during the resting period. It is important to wait until the new growth has roots before watering normally.

Many orchids require a rest period of reduced watering to prepare them for renewed activity and to preserve their normal yearly cycle of growth. These come from areas where there is an extended dry season and they usually flower before resting.

Staking

Tall orchids can become quite disheveled if not properly groomed and supported. Dividing and repotting, particularly, are likely to yield top-heavy plants. For re-establishment, orchids must be held rigidly in the new growing medium. Staking is therefore essential, especially with such tall orchids as dendrobiums and cattleyas. I prefer the type of stake that grips the rim of the pot. It can be quickly made to fit a particular plant, is stable, and can be changed at any time without significant damage to the roots. A good wire bender costing a few dollars, with some #12 wire, will solve most of the staking and support problems in orchid growing.

Foliage Damage

Wetting the foliage on soft-leaved orchids can lead to alarming disfiguration and serious set-back in growth. The new growth on catasetums, cycnoches, lycastes, anguloas, and calanthes is particularly prone to rot if water is left between the leaves. This is especially difficult to deal with when these soft-leaved orchids are under hanging plants or under a bench. Some help can be provided by dusting the growing cup of leaves with a fungicide. Where possible, however, the best solution is to isolate the plants and keep the new foliage dry.

Pruning

A fear of cutting up orchids seems common amongst beginners. It leads to unsightly plants, oversized pots, and sometimes advancement of rot. Old bulbs and objectionable growths should be carved off at repotting time. It is best to dry the cut surface of the bulbs or apply a fungicide before potting. Conscientious

growers *always* sterilize all cutting tools, usually by flaming, to prevent spread of virus.

Pest Control

The task of fighting pests is, no doubt, resented by beginners more than any other aspect of orchid growing. Perhaps this underlies the mistake of careless spraying and incomplete coverage, which speeds the development of resistant pests. A successful orchid grower must learn routine control of insects (six legs), mites (eight legs), and slugs (no legs).

Methoxychlor is a desirable control agent, especially for use in the home, because of its low acute mammalian toxicity. It is about as toxic as common table salt, has an effective residual activity against insects, but is ineffective against spider mites. Malathion is low in acute mammalian toxicity but it has no residual activity and is not very effective against spider mites. It controls only non-resistant adult mites, not juvenile forms, which develop resistance.

For those who can handle toxic materials safely, the systemic type of pesticide provides a most effective defense. Demeton-O-methyl sulfoxide ("Meta Systox-R") is a systemic* which has about the same acute toxicity as nicotine, causes minimum damage to orchid plants and flowers, and controls difficult sucking insects. Mixture of this with a miticide such as "Kelthane" gives the basis for an excellent defensive program.

Orchid growers are prone to provide ideal living quarters for slugs and then complain about their diet of flower spikes and buds. In the war on slugs, the first step is to clean out the damp jetsam from the benches, floor, and crannies. The homeless slugs can then be searched out with a flashlight at night, lured with a potato, or fed metaldehyde in one of the several preparations available at garden stores. ◆

PLANTS FOR A BEGINNER'S HOUSE COLLECTION

An orchid dealer will advise lucky greenhouse owners on suitable plants for the buyer's conditions, but apartment, house, or sunporch growers have a more difficult time, as many dealers have had no direct experience in home culture. Here are a few interesting and available plants which have proved themselves under home culture. And there are many others!

For Warm Conditions

Night temperature near 70°, day near 80°

Angraecum distichum
Cattleya luteola
C. violacea
Epidendrum atropurpureum
E. phoeniceum
Phalaenopsis—most species and hybrids
Mottle-leaved paphiopedilums such as:
P. Harrissianum
P. Maudiae
P. venustum, etc.

For Intermediate Conditions

Night temperature around 60°, day 70°-75°

Catasetum saccatum
Cattleya forbesii
C. mossiae
Calanthe vestita and its hybrids
Epidendrum cochleatum
E. porpax
E. tampense
Hartwegia purpurea
Laelia pumila
Leptotes bicolor
Maxillaria tenuifolia
M. sanguinea
Oncidium Java
Sophrolaelia Psyche

For Cold Conditions

Night temperature 50°-55°, day 65°-70°

Various *Barkeria* species
Dendrobium nobile (cool in winter)
D. kingianum
Odontoglossum hybrids
O. pulchellum
Paphiopedilum insigne
P. Nitens

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*It has been reported that this systemic, and perhaps others, too, permeate the orchid plant very little or none at all.

GREENHOUSE MODIFICATIONS FOR ORCHID CULTURE

Janet and Lee Kuhn

IT is assumed that the reader of these notes already owns a greenhouse and is interested in modifying it to provide the most favorable conditions for orchid culture that can be achieved without totally disrupting the existing structure. It is further assumed that the greenhouse is of sound design and construction and has been kept in a good state of repair. Since in all probability the contents will shortly be worth far more than the greenhouse itself, refurbishing is the first order of business. If there is doubt about the potential life of the structure, a new unit should be carefully considered, as the desire to grow orchids is an irreversible phenomenon.

Control of Light

Light is the basic factor in the culture of all plants, and this is particularly true of orchids. The various genera which are commonly grown require a range of light intensity from a minimum of about 750 foot-candles to full sunlight. Not only does each genus have an optimum light intensity for best growth and flowering, but the different day lengths in latitudes away from the equator (where greenhouses are most needed), as well as seasonal variations, make it mandatory for the greenhouse operator to exercise control of light. The most common method of reducing light intensity is by the use of shading compounds on the exterior surface of the greenhouse glazing. In latitudes where the snow load is a factor, shade cloth, roller blinds, slats and other devices are best used inside.* Nearby deciduous trees are often of great value, since their cycle of maximum and minimum shade roughly coincides with the requirements of many types of orchids.

Wire Panels for Plants

A simple expedient for light control, as well as an efficient utilization of space, consists of panels of stiff wire mesh (1- by 2-inch flat galvanized wire is ideal) hung vertically in various parts of the house above the normal plant level. Orchids grown on slabs of tree-fern root, cork and similar materials may be hung on the panel in such a manner as to shade plants toward the north. Plants may be hung on both sides of the panel, the light lovers on the south side and the shade lovers on the north. If your house has straight walls and is oriented roughly east-west, the north wall can be covered with wire panels to good advantage since very little usable light comes from this area.

Care must be exercised in hanging the panels to assure sufficient strength for full support when wet, particularly if potted orchids are also hung on the wire. Blossom drop after flowering and strong splashing of water on the plants beneath are additional items of care to consider. A grid of properly supported half-inch pipe or conduit overhead provides a convenient arrangement, as plants may be moved around to provide resting periods, protect emerging buds, and so on.

Need for Moisture

Humidity is another important factor in orchid culture. Generally a range of 50 to 70 per cent relative humidity is desired in a varied collection. Control of this humidity requires a source of moisture, generally nozzles or mechanical dispersers, operated by a reliable humidistat and appropriate relays, solenoids, *et cetera*, depending on the system chosen.

*However, shading mounted 6 inches above the greenhouse roof also provides a noticeable drop in temperature in summer, but it must be removed in winter.—Ed.

With humidity comes drip; as the warm, humid greenhouse atmosphere strikes the glazing, condensation occurs. Drip shields made of plastic films placed high over the plants provide an efficient means of controlling this problem. Such shields should not be confused with complete plastic liners, which are intended to insulate, for in cold weather the inner surface of the plastic film will drop below the dew point and condensation will occur, defeating the purpose. For this reason, drip shields are most efficient if arranged in such a manner as to be always at greenhouse air temperature.

Ventilation

Air circulation is vital to good orchid culture as it prevents many fungus diseases and distributes humidity and carbon dioxide (given off by plants or introduced to aid growth). If benches are covered with wire cloth or expanded metal, air movement will be provided beneath the pots and drainage will be aided.

In summer, ventilation and cooling are equally important. Evaporative coolers or pad and fan systems do an excellent job in spite of earlier thinking to the contrary. Exhaust fans for winter ventilation are much to be preferred over the older-style ridge vents. The supply of outside air is provided by a motorized vent at the end of a perforated plastic tube which distributes the cold incoming air and allows it to mix with the greenhouse atmosphere, thus avoiding cold drafts.

Heat

Heating the greenhouse for orchids is the same as heating it for other plants. The system should be of low intensity to avoid desiccation of plants located near a hot spot in the system. Unit heaters with constantly operating fans are becoming increasingly popular and do a good job if properly designed and located to distribute the heat evenly over the entire house. Generally two, or preferably three, greenhouse sections are partitioned off for night temperatures of 45, 55 and 65 degrees Fahrenheit respectively.

Robert Nay

A corner of a newly constructed greenhouse. Note these features: motorized intake louver (top center) which works in conjunction with an exhaust fan at the opposite end of the greenhouse to provide controlled ventilation; covered electrical sockets (*above door*); plastic liner under roof glass, which will be added to the sides; pipe suspended from roof support beam for hanging plants; redwood benches, with well supported cloth over them; automatic humidity system under the bench.

These comments are intended as aids, but are by no means rules, the infringement of which means failure. Part of the fascination of growing orchids is the studying of their requirements and devising original ways to provide them. ♦

Author photos

Over-all view of a sunporch prepared to receive orchids.

ORCHIDS ON A SUNPORCH

Modest adaptation of indoor environment can improve living conditions for people as well as plants

Frederick C. Smith

THE common view that orchids are delicate creatures, requiring a precise balance of moisture, light, temperature, potting material, food and general care, has probably kept thousands of non-greenhouse-owning people from the enjoyment of an especially rewarding hobby. Actually, substantial numbers of the species and hybrids are, as plants go, tough as nails and more determined than a fading debutante. They can be killed, but if you meet them halfway, it won't be easy.

Growing orchids on a sunporch—or on a windowsill or any other people-living space—is mainly a matter of two kinds of adaptation. One is the natural adaptation which the plants will make to your conditions (this can take a year or even more, during which their growth and flowering may be slowed). The other is a modest improvement in the environment that you, the grower, can readily contrive to make the sunporch a much more livable place for the plants—and for you.

Following are the environmental aspects that call for attention when orchids are to be grown on a sunporch:

Moisture—providing more
Light—making the most of too little
Temperature—not too high; not too low
Potting—like providing an oasis in the desert
Summer outing—giving a new lease on life.

Quite a bit of what is said here will

seem to be at odds with conventional orchid literature, but actually, there is no conflict. The standard literature applies to greenhouse conditions where unlimited moisture and humidity can be provided, temperature and ventilation are easily controlled, light comes from all sides except the bottom, and any other feature that a growing plant might require can be furnished. This is a far cry from a room with rugs on the floor, upholstered furniture, a solid roof overhead and steam radiators crackling merrily away as they proceed to desiccate everything.

Moisture

The first photograph shows an arrangement which will help to keep reasonable humidity around the plants and facilitate necessary syringings and waterings. It consists of 18-inch-wide marine grade plywood shelves fastened demountably (by bolts) to the low, protected bookcases which line the window side. On these shelves are placed 9 × 13-inch *aluminum* baking pans filled with ½ to ¾-inch pebbles, with the lips of adjoining pans overlapping so water will not go between but into the pans when hosing or spraying. Plants are placed on the pebbles and drain into them. Thus the pans take care of the surplus water, which then gradually evaporates around the plants. Pot bottoms must be kept above water level to insure perfect drainage.

To protect whatever lies under the shelf, two simple features are required, as shown at Numbers 1 and 2 at the right. These are (1) plastic sheeting covering the entire shelf and running up the window side where the sheeting is fastened to the bottom of the glass by 1½ inch self-adhering plastic tape and (2) a narrow strip of plastic sheeting, also fastened to the bottom of the glass, wide enough to extend down into the pans and thus carry into them any water running down the windows during watering.

Watering facilities can range from atomizer and watering can for a few plants, through a garden sprayer and up to a small-diameter hose with city water supply, if there are many plants.

Light

Most orchid varieties do best with a good deal more light than even the brighter sunporches can provide. The light is less intense than is desirable and it usually comes largely from one side. Artificial light can supplement the natural, but that subject is beyond the scope of this article and it is not essential.

Making the best of the available natural light involves three main directives: (1) Keep plants far enough apart so that each gets a reasonable share of the light (this requires will power, as Nature and your orchid friends make your collection grow). (2) Turn the pots occasionally so that all sides of the plant have a chance at some direct light. (3) Utilize the full area of the window for hanging smaller plants, being careful, however, that they do not shade the larger plants below. (The picture shows half-inch hardware cloth screens used for this purpose.)

Temperature

Largely, temperature will be what you comfortably live with, and this will be

Protective features on a sunporch, described at left: 1 and 2, separate layers of clear plastic, each with a different purpose; 3—hardware cloth for hanging pots, bent at the base to keep plants from touching the window glass.

quite all right with the large group of "intermediate" orchid varieties which do very well on a sunporch. Cattleyas, oncidiums, epidendrums and many of the delightful "botanicals" have numerous representatives in this class.

For localities where sub-freezing temperatures are a standard winter feature, it is important that the sunporch be double-glazed, that is, equipped with storm sash. A further necessary precaution is to keep plants that are hung at the windows from touching the glass. This is easily accomplished by bending the bottom 2 inches of the hardware-cloth hangers at right angles so that they keep the plants that distance away from the windows as shown at (3) in the photograph.

A night temperature drop of 5 to 10 degrees is distinctly beneficial. Most homeowners drop the furnace setting 5 degrees or so at night anyhow, and this will help. If the sunporch can be closed off during the evening and night by French doors or other means, the larger (and more desirable) temperature drop can usually be secured.

Potting

Orchids can grow in and on almost anything—if you have a greenhouse where you can have them continuously surrounded with plenty of humidity to keep them plump and fit. Not so on a sunporch where even the substantial assists described previously will achieve somewhat less than optimum conditions during the peak heating season.

Fir bark as a potting medium will work on a sunporch but it requires nearly daily watering. Osmunda holds moisture better and requires less watering. Best of all, it seems, are the new mixes which combine fir bark with redwood fiber, peat and perlite. These provide a real oasis for the plants and usually require watering not oftener than every three days or so. We have given up trying to grow on tree-fern slabs, cork, etc.—we just can't seem to keep them moist enough.

Whatever potting medium is used, be sure not to try to get too much "mileage" out of it. Remember that when the medium goes bad, the roots go out of business too and the plant is deprived of both moisture and nourishment. A good rule is to repot plants every two years whether they seem to need it or not. It is important to do this in spring or early summer to give the plants the best chance to re-establish themselves while humidity is high.

Summer Outing

If you are not an apartment dweller and have a yard available to you, give your plants an outing for the summer. Sunlight, rain and constant movement of air will do wonders for them. Furthermore, the whole arrangement will do wonders for you by greatly simplifying care.

You can put the plants outdoors at whatever time tomatoes can safely be planted (usually Memorial Day in the New York City area). They can stay out until night temperatures consistently drop to the lower 50's (Fahrenheit). Somewhat lower temperatures won't hurt them but their processes will be slowed and you might be caught by frost.

The plants will stand a good deal of light but usually there should be broken shade or light screening during the heat of the day. They can be placed on any kind of plant stand or hung from trees, shrubs or sides of buildings, so long as they get the light and moisture they require. ◆

WHAT'S IN A NAME?

(Continued from page 11)

about using botanical names rather than common names. In orchids, with something in the range of 30,000 species, remembering the different names is not easily accomplished, but to attempt to create and use inexact common names should seem foolish even to the beginner. Embarrassment over mispronunciations should not bother you. Simply be prepared to be corrected. ◆

LIGHTS ON ORCHIDS

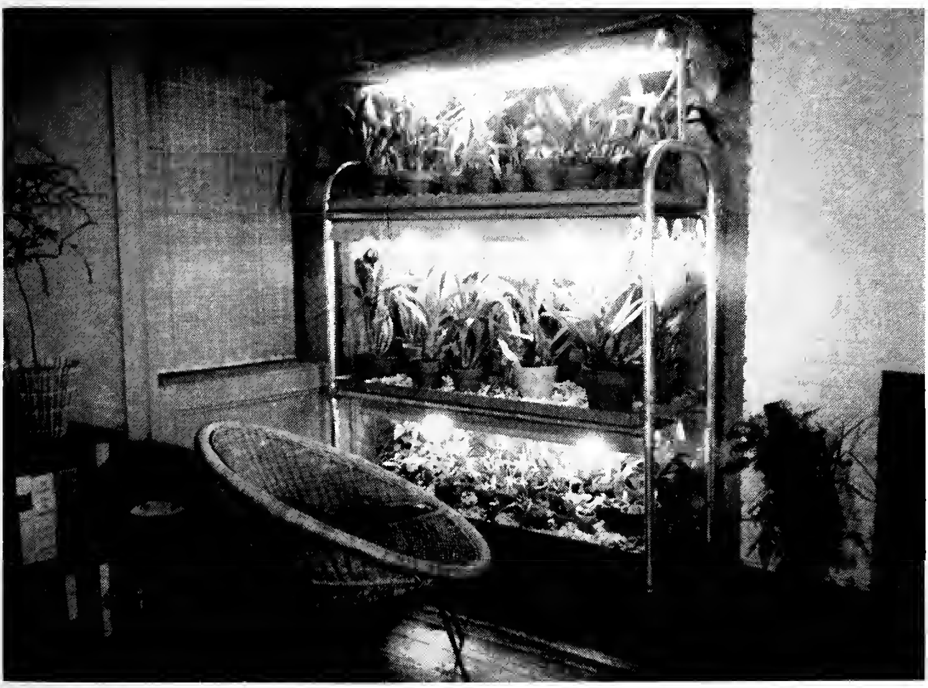
Fluorescent fixtures bring rewards in better growth and bloom

Thomas Powell

LACK of natural light is most often the limiting factor in growing orchids in the home. But artificial light—of the right kind, duration and intensity—can make orchids grow and bloom as vigorously in a sunless home or apartment as in a greenhouse!

The first factor, the type or quality of the light, is most important and has been the subject of considerable research over the past decade. As the secrets of this aspect of the new science of "phytoillumination" (growing plants with man-made light) are revealed, success with an ever wider range of orchids is becoming assured. Today you can see enthusiasts growing every type of orchid in every room of the home, in enclosed cases, on plant carts, book shelves, kitchen counters, room dividers, and in closets and all types of cabinets.

Numerous studies attempting to duplicate natural sunlight have shown that the blue and red portions of the spectrum are the wave lengths most needed by plants for photosynthesis. It is now known that fluorescent lights are a good source of radiant energy for plant growth, but function best when supplemented by incandescent bulbs. Far red rays from the latter are vital for triggering many growth and flowering responses. Plant lighting engineers currently recommend the following combinations: standard



Thomas Powell

Lighted orchid plant cart in the author's living room.

cool white or daylight fluorescent tubes and incandescent bulbs in a 5:1 ratio (5 watts of fluorescent to 1 of incandescent); cool white or daylight plant growth tubes, and incandescents in a 5:5:1 ratio; and plant growth tubes and incandescents, 5:1 ratio.

There is considerable controversy over which combination is "ideal," but all give good results. Probably as in so many other aspects of plant science, the final answer will come through experimentation by amateur growers. The new "plant growth" fluorescent tubes, incidentally, appeal to many hobbyists because the lavender glow they cast enhances many orchid flower colors.

A minimum of four 40-watt fluorescent tubes and four 25-watt incandescent bulbs is needed to provide adequate light for a varied collection containing many orchid genera. The tubes should be mounted about 4 inches apart on centers, with the bulbs spaced as evenly as possible between them. Because the standard 120-volt incandescent bulbs we use in homes and offices produce considerable heat, it is better to use the commercial "extended service" 130-volt bulbs. These burn much cooler, radiate more far red rays, and last more than twice as long. Available at any electrical supply store, they cost about the same as standard bulbs.

For further reduction of heat, the ballasts in the fluorescents can be mounted away from the unit, and/or a layer of Du Pont Mylar-W plastic placed directly below the lamps. The plastic has the additional advantage of filtering out a band called "near ultraviolet," emitted by all fluorescents and believed to be inhibiting to plant growth.

Knowing the minimum light needed, the grower will use his ingenuity to determine the details of his lighting set-up. Fluorescent fixtures with reflectors and sockets for incandescent bulbs are available in several designs, or you can mount individual strip or channel units and sockets on wooden panels to make up any arrangement you wish for a special area. For higher light intensities, there are high output, grooved and reflectorized tubes, as well as an 80-watt panel fluorescent lamp 12 inches square that may be mounted in rows to give high concentrations of light. Lumeline tubular incandescents are easily set between the panels to provide the needed far red radiation. Even the three-lamp Circleline units common in kitchens will give good illumination over several square feet, especially if the outer lamp is a high output type; a socket for an incandescent bulb can be installed in the center of the fixture.

If you use standard tubes rather than high output types, use the longest tubes possible (the intensity falls off towards the ends of fluorescent tubes), or mount strip units at right angles at the ends of the bank of tubes. All mounting surfaces should be painted white for high reflectance. For safety's sake, call in an electrician to do any but the simplest wiring jobs. Figure on replacing the fluorescent tubes annually, as their output decreases with age.

With the minimum four 40-watt tube set-up, light-loving orchids should be kept as close to the tubes as possible. Paphiopedilums, phalaenopsis, and others that prefer much lower light conditions will do best 12 inches or more below the tubes, or on the fringes of the lighted area. For cymbidiums, vandas and others needing very high intensity, set-ups providing more light are necessary—and incidentally are useful for all genera if you want to keep the fixtures high above the plants for reasons of décor. With any set-up, small plants can be raised on inverted pots or on platforms if they need more light.

Most growers give their orchids 14 hours of artificial light a day throughout the year. Orchids, with a few exceptions, appear to exhibit a "day-neutral" photoperiodic response: their growth and flowering cycles are not affected by seasonal changes in day and night lengths (unlike chrysanthemums, for example, which must have short days to initiate buds). An automatic timer is very useful to turn the lights on and off at specified times each day.

Gottscho-Schleisner

Orchids growing under lights at Eagleridge, the Merck estate (set-up arranged by Don Richardson).

The cultural needs of orchids under lights differ only slightly from those of orchids grown under natural light. The night temperature range you can provide is crucial in your selection of plants. Fortunately most orchids fall into the "intermediate" group, preferring 55° to 60°F. at night, easily achieved in today's thermostatically controlled homes. However, heating or cooling is usually not too difficult to provide if you want to grow "warm" (65° to 70°) or "cool" (50° to 55°) genera.

Humidity is not as easy to control, but often the popular tray-and-gravel method will provide the desired 50 to 60 per cent. Use a deep tray with a couple of inches of gravel or similar material and an inch of water. Set the plants on the gravel, making certain the water never touches the bottoms of the pots (to avoid rotted roots). Wooden trays may be used if lined with plastic, or you can have rust-proof metal trays custom-made. To prevent the gravel's becoming coated with algae, treat every few months with 1/4 teaspoon of copper sulfate (from the drugstore) per gallon of water, but make sure the pots do not touch the water.

Enclosing the growing area in plastic also works well, but provision must be made to pull back the plastic as needed for ventilation and heat control. Or you can fog your plants occasionally with a hand mist sprayer, an especially helpful technique for newly potted orchids with few roots or plants on slabs that tend to dry out rapidly. Finally, a small humidifier of the inexpensive cold vapor type—rather than a steam vaporizer—is excellent in many situations. This can be equipped with a humidistat so that it will operate only when the humidity falls below a prescribed level.

Good ventilation is important both to prevent fungus diseases and to insure an adequate supply of the carbon dioxide essential to photosynthesis. One or more small fans that produce a slight movement of air, or a distant window open a crack except in the coldest weather, will help greatly to assure vigorous growth. Some growers believe carbon dioxide is so vital they supplement the air's natural supply by burning candles or using other methods, and report a definite stimulation of growth.

Every grower must work out a watering schedule to fit his conditions of temperature and so on. For feeding, the most successful routine seems to be a quarter-strength 20-20-20 formula with every second watering, supplemented with fish emulsion once a month. There is evidence that heavy feeders like cymbidiums will benefit from additional monthly feedings of dried manure or manure water.

Experiments by amateurs are showing exciting potentialities for artificial light culture. Lights, for instance, will speed up the growth of orchid seedlings phenomenally. Under high light intensities, cattleyas can be raised from flask to flowering in less than three years, with high levels of water, nutrients and humidity and an 18-hour photoperiod.

Remember that some orchids may take as long as two years to become "acclimated" to artificial light conditions. However, thereafter they may bloom more often than the same varieties in the greenhouse. Thus, growing under lights can be not only more exciting and challenging, but more rewarding as well. ◆

ORCHIDS IN THE BASEMENT

Aphrodite J. Hofsommer

IF one lives in a climate too warm, too cold, with days too dark and too short in the winter, or if one lacks the space or simply does not wish to be tied to a greenhouse, orchids can be grown under artificial light in a basement, utility room, sun-parlor or attic.

For fourteen years my husband and I grew orchids in an ex-coal bin in the basement of our Webster Groves, Missouri, home. We had this room, 9 x 11, painted, walls and ceiling, with white flat latex paint, which reflected more diffused light than would a glossy finish. My husband built two benches the length of the room, 32 inches wide and 42 inches high (measured from the floor) and over these hung a battery of fluorescent fixtures which eventually provided 36 four-foot, 40-watt fluorescent tubes. There were four four-tube fixtures, two abreast and two length to length above each bench, and one four-tube fixture under the coolest bench for wintering cymbidiums, dendrobiums and odontoglossums.

Through the years, and with the introduction of the Gro-Lux fluorescent tubes, we found by trial and error that the most satisfactory combination of light for orchids was Daylight, Delux Cool White and Gro-Lux in 3-2-2 ratio, with 10 per cent in wattage of incandescent bulbs added. These were hung between the benches to avoid burning of leaves and to boost the red end of the spectrum with extra infra-red energy. Gro-Lux tubes used alone over one bench of orchids for a year enhanced vegetative growth but retarded floriferousness. The light intensity as measured by an electrical engineer at 6 inches below and in the center of a battery of eight tubes was 1,500 foot-candles. Leaves that reached to 3 inches below the tubes suffered no burning. We hung the plants out of doors for the three summer months, in full sun except from 10 a.m. to 3 p.m., when a maple tree provided filtered sunlight. For the nine months in the basement, the light length was 13½ hours daily.

Humidity

Ever present in our "Green Thumb Room" was the battle for humidity, but since relative humidity was the real goal, a sunless room provided adequate growing conditions with 40 to 50 per cent humidity. Several means of maintaining this were used. A cool-vapor room humidifier which vaporized about one gallon of water a day distributed by a small fan at the outlet was placed on a table at one end of the room.

Galvanized asphalt-painted trays 3 inches deep covered all benches and contained an inch or so of river gravel and water. On top of the trays were grills or old refrigerator shelves, and on these stood the pots. The run-off from watering the potting media drained into the gravel. One could either siphon this off from time to time or provide the trays with spigots or troughs above the desired water level. Leaves were misted once a day, the concrete floor sprinkled.

A 10-inch floor fan directed to the ceiling drove cool moist air up and around the room. Of course, the humidifier and floor fan automatically shut off with the lights in the evening. Then we opened the small coal-chute window behind a curtain, as necessary, to reduce the night temperature to 55 or 60 degrees. This drop from the day temperature of 75 to 80 degrees was needed to promote flowering.

Heat

No heat was provided for this basement orchid room other than that created by the fluorescent fixtures, tubes, and the incandescent bulbs. The living-room floor formed the ceiling and a gas furnace was located about 6 feet from the door. Fresh air which entered the window was dis-

Author photo

Close-up of one section of the author's basement "green thumb" room where she raises orchids.

tributed by the floor fan by day; at night we left the door ajar a few inches.

Watering and Feeding

In our first few years of orchid culture, all our potting was in osmunda fiber, later in fir bark, and finally in a 3-1-1 mix of fir bark, coarsely shredded redwood bark and Hawaiian hapuu. There was ever present the booby trap of over-wet potting media, the anathema of this type of indoor culture, for the medium can be dry on the surface but very wet below, since sunlight is never present to warm the pots. One method of examining the contents was to force a thin wooden probe deeply into the pot. When it was extracted after a few minutes, dampness was easily discovered. If present, only misting was practiced. On the average, one pot watering every ten days sufficed for pots more than 8 inches in diameter, one a week for 6- to 8-inch sizes, and two a week for 4- to 6-inch pots. The 2- and 3-inch hanging pots were watered as necessary, drainage falling into the gravel pans.

Feeding under these conditions was limited to a weak quarter- or half-strength solution about once a month, but in the summer out of doors with high light intensity, full strength solutions of high nitrogen fertilizers were watered into the pots and sprayed onto the leaves once a week.

Results

The results of this type of artificially lighted orchid culture really exceeded our expectations. There were blooms on the plants the year around. Buds, initiated under lights, burst into bloom from late winter to fall. Those initiated out of doors bloomed in fall and winter; the flowers were not in any way superior to those initiated under lights. Plants had no rest period. New leads, sheaths and flowers appeared month after month. We grew and flowered cattleyas, dendrobiums, phalaenopsis, odontoglossum hybrids, cycnoches, brassias, chysis, epidendrums, cymbidiums and catasetums. Some cool genera were left in the basement all year, benefiting from the even temperature and eighteen hours of light given them when flowering size cattleyas were away from the long bloom-inhibiting light periods.

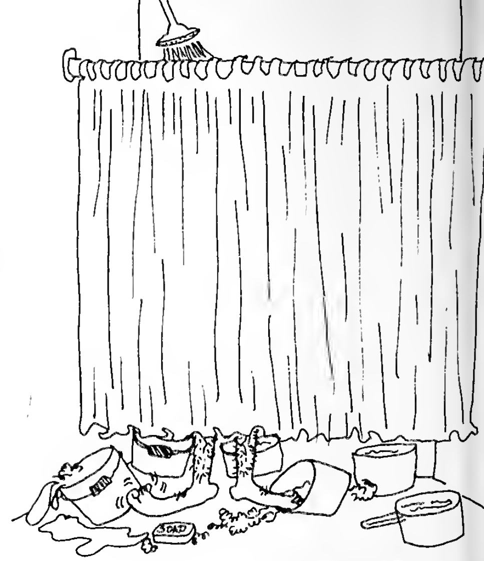
Advantages

The upkeep of a basement orchid room depends only on the number of light tubes using power and their replacement as necessary. The hobbyist can travel without fear of his collection freezing, overheating, drying. Someone needs to come in to water but once a week. Growth of plants proceeds uninterrupted throughout the year, and seedlings started a few inches from the lights can be made to bloom in three or four years. ◆

ORCHIDS IN THE FAMILY

Home cultivation in retrospect from plastic flat to greenhouse

Brenda Weisman



Sydney Kenna

Growing orchids during the drought years called for extreme measures of water conservation.

SOME years ago, after settling into a routine of homemaking and motherhood, I discovered that there still seemed to be any number of shining hours that could stand improving. Consequently, I enrolled in the first available course at the Brooklyn Botanic Garden, just across the street. The course happened to deal with orchids, about which I knew very little beyond the old wives' tale concerning the impossibility of growing these exotic plants in a cold climate. In spending the next month replacing Doctor Spock with orchidologist Doctor Withner, I reached the conclusion that orchids in the living room were worth trying, and over the next eight years found them equally rewarding in the bathroom and kitchen as well.

The first plants—two hybrid cattleyas, one mottled-leaved paphiopedilum and *Brassavola nodosa*—were installed in a plastic flat containing wet gravel and covered with a plastic tent draped over two reshaped wire hangers, since the primary concern from the start was maintenance of humidity. As for other essential cultural conditions, the eastern exposure couldn't be helped, and we presumably had the only non-adjustable, constant heating system in Brooklyn, so that it had to be ignored also. *Brassavola nodosa* flourished under any conditions to which we exposed it, succumbing only when we finally built a greenhouse! It also provided our first orchid thrill, home-grown roots, as exciting as a baby's first tooth. The cattleyas bloomed on schedule, delighted us and impressed our friends, while the paphiopedilum never bloomed at all until it was placed in the greenhouse. These first successes so impressed my husband that my anniversary gift was a 6- by 3-foot butcher's display case equipped with sliding glass doors, stainless steel trays and fluorescent lights. He just happened to pick it up at an auction and thought it might be useful in the living room, so for forty dollars we had a perfect indoor greenhouse which required only the addition of a small blower to keep the enclosed air in motion.

We acquired more cattleyas, some dendrobiums (always a mistake for me), a few oncidiums, and also a new job. With this, we moved to a small garden apartment with a southern exposure—in the bathroom. The window was over the combination tub-shower and for some unaccountable reason the tiled sill measured 2 feet by 1 foot. The window was soon crammed with orchids from top to bottom, with some even lashed to the frame and shower rod. We just about needed a machete to take a shower, the conditions being roughly comparable to a tropical rain forest. The following new plants grew and bloomed: *Aspasia variegata, Brassavola cordata, Isochilus linearis, Maxillaria* species, *Oncidium ornitho-*

rhynchum, Pleurothallis tribuloides and *Restrepia striata.* These plants were included in our collection, not by design, but because they came as guests or gifts. Very few were purchased those first few years. In retrospect, a better balanced collection would have been more satisfactory for a beginner, but beginning collections, like Topsy, just grow; they are rarely planned.

Since this apartment barely had room for a crib, let alone our butcher's case, it took exactly one month of togetherness with baby number two to find and buy a house for which the prime selling point was an unheated sunporch facing south. The case was set up with a waterproof heating cable imbedded in gravel and attached to a thermostat set at 55 degrees. That was the winter of 1961-62 and just about everything bloomed. After the summer out of doors, their first, and the winter of 1962-63 in the case, the plants once again produced strong new growths and flowers.

New to the collection were some bulbophyllums, *Coelogyne fimbriata, Maxillaria tenuifolia, Phaius tankervilliae, Symphyglossum sanguineum,* and unnamed cattleyas, but by now so many miniatures were being neglected among the larger plants in the display case and on our kitchen windowsill that we decided to install fluorescent lighting on a corner of the kitchen counter. The set-up consisted of small plastic flats of water topped by rubber-covered wire racks for the plants and a small blower to keep the air moving constantly. Three 3-foot Gro-Lux tubes were attached to the cabinets and the plants were kept as close to the lights as possible without actually touching. We enjoyed this kitchen nursery for two years and, as a purely subjective evaluation, the plants were healthier and more prolific under the regime of summer outside and winter in the kitchen under lights than under our other conditions then prevailing. In our butcher's case, the little ones were consistently under- or over-watered and on the windowsill we never had adequate humidity except after watering.

Robert E. Hurwitz

The yellow-flowered miniature orchid *Oncidium cheirophorum,* a cool grower from Panama, was not attempted until we had a greenhouse.

By the winter of 1963-64 a tenth anniversary overtook us and the only logical gift was a greenhouse added to the sunporch.

Reams have been written about the greenhouse mystique, and mystique (or perhaps neurosis) it is. We now had growing and blooming all of our old plants plus *Cattleytonia* Rosy Jewel, *Phalaenopsis lueddemanniana, Epidendrum matthewsii, E. porpax, E. tampense, Maxillaria sanguinea, Mystacidium distichum, Oncidium auriferum, O. cheirophorum, Scaphosepalum verrucosum, Rodriguezia fragrans* and *R. venusta.*

By paying careful attention to the small details like water, heat, humidity, ventilation and pests of all sorts from the two-legged to the ultra-microscopic, greenhouse growing seemed so simple, so unproblematical, that in the summer of 1965 drought regulations went into effect, so it seemed, just to put us to the test. This meant no sprinklers, no hoses, no tap water for non-essential purposes, and the least essential of all was the watering of plants. (*Concluded on page* 42)

FINDING ORCHIDS IN THE WILD

An explorer reports on his experiences in Venezuela

G. C. K. Dunsterville

Illustrated with photographs by the author

BETWEEN the orchid collecting of today and the orchid collecting of a hundred years ago, there are some fundamental differences in some aspects and not much difference in others. In the early days of the orchid fever, the commercial horticulturist and the rich amateur grower were the principal parties involved in temperate climates; the professional collector financed by the horticulturist was the principal party in the tropical zone, very often working through uneducated peasant collectors incapable of telling "wanted" from "unwanted" and recklessly stripping large areas in the process. Today, this side of orchid collecting has changed in degree more than in intent. The few rich amateur growers have been replaced by the not-so-rich but far more numerous group of people interested in growing species orchids. The enormous losses in plants between tropical export point and temperate import point have been greatly reduced by improved knowledge of how to handle plants for shipment and by far swifter means of transport. And knowledge of how to treat the plants after they have arrived is incomparably better than it was. Where, in the old days, probably not one plant in a thousand of those collected from the tropical trees was alive a year later, nowadays a hundred or more might have a fair chance of survival. Equally, the old habits of shipment by the ton are now virtually non-existent, as nearly all governments in tropical orchid countries have enacted laws limiting, if not entirely prohibiting, export of live plants. But these are changes in detail. What has not changed is the existence of a commercial incentive behind the collecting of tropical orchids, and while this exists some degree of forest stripping will also exist. The importer in the temperate climate may be, no doubt is, a man of great rectitude, but the collecting chain that his import business starts may, and sadly still often does, end in uneducated and irresponsible hands stripping the trees and even felling them. Fortunately this is rarely on the horrifying and fantastic scale of years gone by, but is still on a scale large enough to cause concern to any conservation-minded person. It is far worse in countries with poor laws or weak enforcement, but is present in all tropical countries in some degree. The stripping mentality at the further end of the chain is still there and the attrition continues.

The really new factor in the overall picture of orchid collecting comes from quite a different sector, that of the non-commercial orchidophile on the spot, that oh-so-lucky person who is able to indulge his yen to grow orchid species on the basis of plants that he himself is able to go and collect in the wild, thus adding an element to his hobby that lifts it into a class that surely must exceed practically any other pastime conceivable. The number of orchidophiles so concerned is still quite small in most tropical countries—in some of them, incredibly, almost nil—so that for conservation they create no problem. Moreover, even if their numbers increase enormously, it still seems doubtful if they will ever constitute a menace. This is not necessarily because they are pure in heart, but because their needs are self-limiting by virtue of both money and time. They do not send unscrupulous hands out into the forest to strip a thousand plants in the hope of getting one; they wait until they have time, and if necessary, money, to go and collect themselves, using a skilled eye and a strictly limited appetite. Their ambition is to add a few plants to their own collections and to help others less fortunately

placed with an occasional gift of a plant. If they ever buy or sell a species plant it is on the rarest of occasions.

There is, with respect to some species in some countries, a third origin of collecting, and that is the more or less orchid-ignorant public. In such countries it is popular to have a few plants of the more showy species around the house, even if knowledge of how to treat them is minimal and plant fatality high. Such a local market can provide adequate funds to initiate once more that collecting chain that ends in unscrupulous stripping, operating through street vendors and peasant flower markets rather than through the commercial horticulturist; control of this (or its lack) is the responsibility of local authorities.

Spectacular flowers are generally of somewhat secondary concern to the true species collector in the tropics. Having normally at least a fair amount of space, either in a garden or on a roof top, and being unconcerned with expensive glazing or heating problems, he is ideally suited to indulge a taste for the more humble "botanicals" as well as maintaining an interest in "commercials" or beautiful hybrids. The expeditions of such a collector will fall into two completely distinct classes—"civilized" and "uncivilized"—depending upon his tastes and the time and effort he can devote to the collecting side of his hobby. In this, Venezuela can be taken as a good example, to the extent that it is amply provided with scope for both types of collecting.

"Civilized" collecting is carried out in the developed part of the country, which can roughly be considered as the part lying north of the Orinoco. Here there is an extensive grid of first-class highways and good paved roads, supplemented by dirt roads on the fringes, and occasional "penetration roads" into new country for the jeep-equipped collector. The area covers everything from sea-level desert to everlasting snows, and the variety of orchid habitats is endless. All the collector

"Penetration roads" (scouting the way through virgin territory for a permanent road to follow) are a godsend to the orchid hunter, but not when it gets too wet.

Where rivers are small or where rapids are frequent, river travel is mainly in open dugout canoes with outboard motors. Convenience rather than comfort is the keynote.

need do is to take a few hours or days off, put on old clothes, pick up toothbrush and machete, and drive off. He will be able to choose roads running at sea level or at 14,000 feet, or even a cable-car in one spot to take him up to nearly 16,000 feet if he has ambitions to find a species growing as high as that. In hot low-level scrubland he will find orchids in bulk, even if the variety may be limited largely to tough plants such as schomburgkias and terete-leaved oncidiums or brassavolas. As he drives to higher levels he will pass through "hot," "intermediate" and finally "cool" forests, most of them the home of a great variety of orchid life. Within a Sunday-outing from Caracas a rain-forest tree has been noted with no less than 48 separate species on it;* trees with 15 to 20 species are common, though the orchids on them are usually far out of reach. To get the best out of such collecting the orchid fan may have to cut his way a bit into the forest here and there, or climb up or down some effort-taking slopes, but it remains truly "civilized" collecting. Many species can be found without going more than 100 feet from the roadside, and the wife and kiddies can come along too.

This civilized collecting is something utterly distinct from the collecting of a hundred years ago, first, because it is being done by people who aim to grow the plants they find, not pass them down the line to some unknown hand for a packet of "filthy lucre," and second, because fine roads and cars have replaced country tracks and burros as the means of getting around. By contrast, "uncivilized" collecting in the "interior" south of the Orinoco still retains many aspects that would have been familiar to the botanical collector of times gone by, and because of the remoteness of its locale is still fortunately fairly free of the devastating hand of the commercial collector's minions. Roads help to get to the edge of this wonderland and airplanes

Modern transport sometimes breaks down and stone-age manpower is needed for pushing.

*American Orchid Society Bulletin, May 1961, or the author's book *Introduction to the World of Orchids*.—Ed.

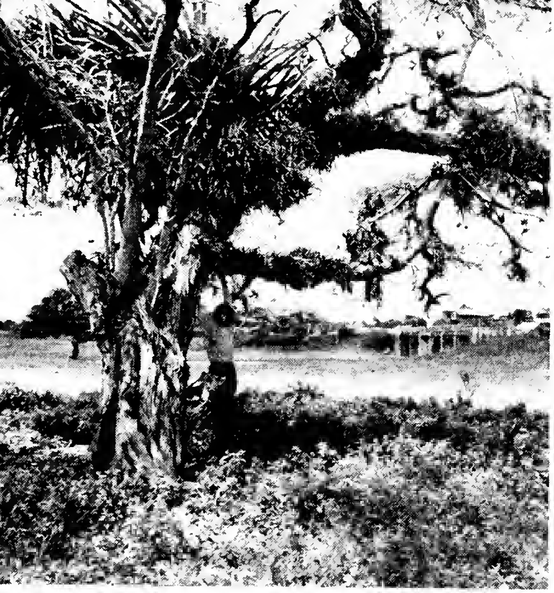
penetrate it to certain key spots. After that it is largely a matter of going up or down unspoiled rivers or hiking age-old trails where the machete, an occasional shotgun, outboard motors and canned food in the larder are the only signs of modernity. As a result, where Humboldt paddled his canoe slowly, today's traveler in the self-same craft hurtles swiftly along (until the gasoline gives out); where Humboldt went hungry if game failed him, today's traveler opens a can of sardines. And as a byproduct of all this, where Humboldt spent a dollar, today's traveler spends ten or more.

I have previously boldly stated that collecting and growing your own orchid species is a hobby par excellence. Those who can do this collecting in the almost uninhabited interior are doubly blessed—the orchid reward is rich and the country often spectacularly beautiful and utterly fascinating. It calls, of course, for an appreciation of "*un*civilization" and a readiness to do without many comforts of home life: acceptance, in brief, of the fact that you are on your own in a world where Nature is paramount. It calls for quite a lot of money now that gasoline is a major ingredient and that many of the Indian porters or river men, even if scantily clad, are now transistor-minded. Above all, it calls for time. To some extent time and money are interchangeable. Time in the interior is flexible, and any attempt to firm it up is expensive, to make it rigid practically prohibitive. If you are content to start an up-river trip "some time within a few days" you can hunt and bargain around to find the best dugout, the soundest motor and *motorista* and the soberest crew. To start "not later than the day after tomorrow" will cost you more, if only in later finding that man or motor is not of the best. If you want to be really civilized and "start tomorrow at 6 a.m. sharp," then your only hope (and a hope is all it will be) is to pay for the services of a courier to visit the spot a week or so ahead of you and have everything—or almost everything—ready and waiting for you. In retrospect this airy-fairy attitude to time

In the forest, orchids grow unmolested in trees that are far too large to be climbed. Once in a while, however, clearing for cultivation will expose some of these orchid-laden giants to full view. Deprived of the forest's self-created and self-maintained humidity, these trees are destined to die fairly soon. Lucky is the orchid man who happens to be around when they fall.

and agreed dates is quite amusing: at the time itself it is infuriating to the point of murder. It is fun to look back on that time when truck transport had been firmly arranged to meet you at the end of a river trip to take you fifty miles over a savanna track to the nearest point of contact with the outside world. At the time, however, you felt quite differently about having to bed down on beer-can

A *bongo* is a medium-size dugout canoe (*curiara*) equipped with a small roof of tin or thatch. The roof is a great help in keeping the collected orchids from "stewing" in the hot sun.



While the cooler forests of mountain slopes generally harbor a greater variety of orchid life, hot country trees sometimes bear masses of one or two species. This gnarled acacia almost at sea level is host to a thousand or more plants of *Brassavola nodosa*, a much prized species in many collections. On top is a large bromeliad.

and chicken-gut littered rocks among a collection of abandoned dugouts in an uninhabited spot, wondering whether it will be less than a week before your or some other truck happens by, and what you will eat in the meantime.

But given adequate resources of time and money, few places can offer more genuine pleasure to the private orchid collector who has in him at least a bit of the wish to "get away from it all" for awhile. His travel will be principally by dugout canoe, up rivers that cut through country as near to being uninhabited as can be found on this overpopulated globe outside the deserts and the polar zones. He can stop where he likes, when he likes, and explore everything within reach. If he wants to put foot on the top of one of those dramatically beautiful cliff-walled "tepui" table mountains glimpsed occasionally in the blue distance, he will need more time yet, will have to use muscle instead of gasoline, and will need plentiful resources to pay for porters to carry his food and baggage, porters to carry ditto for the first lot of porters, and so on deep into his bank account. By the time the trip is over, his muscles may be sore but his waistline will be a joy to contemplate, and he will be most unlucky if those few bundles of carefully selected orchid plants he has managed to bring back do not contain many rarities and maybe even a new species or two.

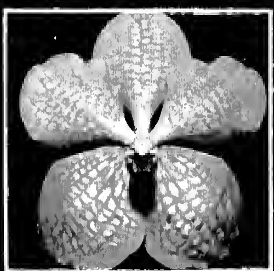
River travel is of two quite distinct types—travel on the wide calm waters of a main stream, such as that of several hundred miles of the Upper Orinoco, and travel on narrower rivers whose course is broken by frequent rapids. In all cases the craft is almost certain to be a dugout canoe with outboard motor, but there the resemblance ends. On the big wide streams you can use the big wide *falca*, a dugout with plank-raised sides, measuring up to 50 feet by 8, and powered by an enormous outboard with a great appetite for gasoline. You will have an ample roof over your head and many comforts, but the view will be mostly monotonous and

Another location for *Brassavola nodosa*, on a large plant in a cactus forest.

SOPHROLAELIOCATTLEYA FALCON 'ALEXANDERI'

ASCOCENDA MEDA ARNOLD

CATTLEYA SKINNERI var. ALBA



VANDA ROTHSCHILDIANA

BROUGHTONIA SANGUINEA

ONCIDIUM AMPLIATUM var. MAJUS

RHYNCHOSTYLIS COELESTIS

Color separations courtesy of Jones & Scully

COELOGYNE CRISTATA

Orchids aro

Southeast Asia, according to b
original homeland of the Orch
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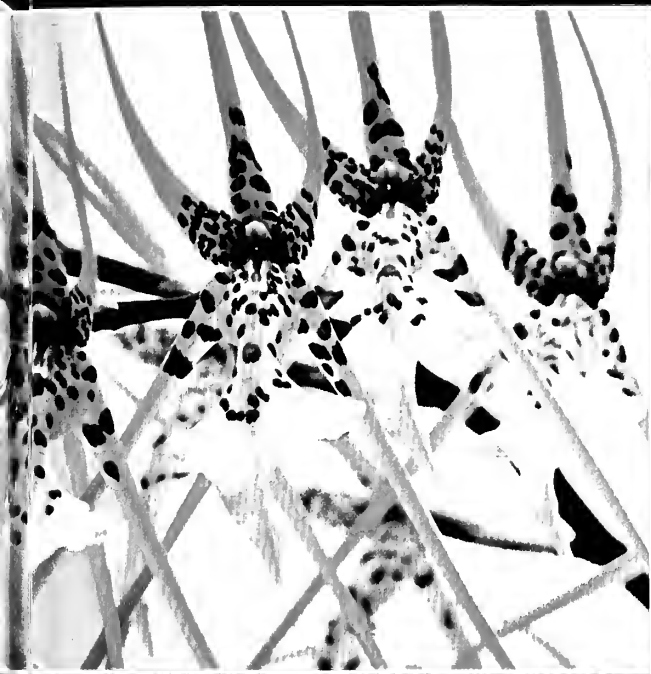
MILTONIA CAND

...A MACULATA var. GUTTATA



MASDEVALLIA BELLA

...the World

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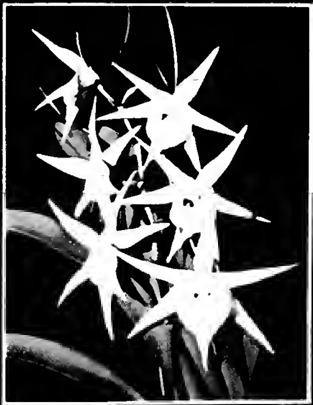
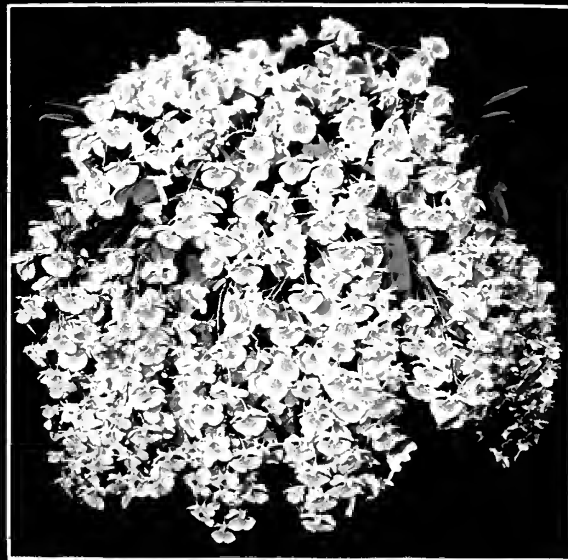
CATTLEYA SCHILLERIANA

Printed by C. Harrison Conroy



ANGRAECUM VEITCHII



DENDROBIUM AGGREGATUM var. MAJUS

CATTLEYA WALKERIANA ALBA

BRASSOLAELIOCATTLEYA MARY M. DAMON

CATASETUM PILEATUM
var. AURANTIACUM

CATTLEYA GUTTATA var. LEOPOLDI

BRASSIA MACULATA

the insect plague may be misery-making. On such rivers less expensive and rather cramped accommodation is provided by the *bongo,* a smaller dugout with a smaller roof and a less greedy outboard motor. On rapids-filled rivers the craft will be an open dugout or *curiara,* normally around 20 to 35 feet and fairly narrow, characterized by the absence of any roof: this has its disadvantages but does help both captain and passengers to avoid going down with the ship when it hits a rock. The countryside is likely to be very beautiful indeed, and the stops to walk around rapids while the crew manhandles the *curiara* provide excellent opportunities for orchid hunting as well as much needed relief from the cramped position enforced on board. At night you will mostly be sleeping in a hammock, sheltered from the possible rain by a plastic or other tarpaulin, but whether this will be hung in a clean virgin forest or an unclean Indian *sitio* will depend on luck or skill at avoiding the latter. Only the most unwise will stay at an abandoned *sitio* because the probable cause for its abandonment will have been an excess of parasites such as chiggers beyond even the capacity of the Indian to withstand. Game and fish in most of these smaller (but not necessarily small) rivers often tends to be scarce due to some obscure connection with the humic acid in their red waters, so basic food supplies will have to be brought along. In compensation there will be little *plaga.* In the white-water areas, usually the wider streams of the Upper Orinoco Basin, there will be plenty of game and fish, from the much-appreciated *lapa* to stranger foods such as alligator-tail or monkey. The Indians with you will be expert at seeing these animals when static, and thus expert at shooting them. If they succeed in killing a tapir of 300 pounds, you have to travel the next week very odoriferously while the excess meat dries in the sun under your nose. To pay for this bountifulness of food there will usually be equal bounty in the way of clouds of mosquitoes and sandflies to make your days a misery, while alligators

Eriopsis biloba is one of the many Venezuelan orchids that grows prolifically in the scrub vegetation of shallow sandy soils on top of sandstone table mountains, 5,000 to 8,000 feet above sea level.

in some parts, and vicious caribe fish in most parts, combine to make bathing risky. Snakes, jaguars and a few other potent animals will be present, but will be fortunately every bit as interested in keeping away from you as you from them.

Orchid booty must, for limitations of transport capacity, be kept to a well selected minimum except where the whole trip can be done by large *falca.* The main enemies to its arrival back home in good condition are heat-plus-damp, and compaction beneath some heavy weight such as a human rump or a large outboard motor. The compaction danger is met by keeping alert at all times, but the risk of heat and damp is harder to combat. The

use of plastic bags (not closed) to maintain freshness in some plants is of advantage, but needs extreme care as direct tropical sun on such a package can reduce its contents to stewed spinach in a matter almost of seconds. Plants should have the more malevolent insects removed, the roots pruned well back, and then be well dried out: with high atmospheric humidity and with little cover against rain, this is seldom easy to accomplish and "as dry as possible" is often not really dry enough. Indian-woven baskets, or bundles wrapped in plaited palm-leaf, provide good basic protection combined with fair ventilation, but while on the river in full sun it is necessary to cover everything with towels or old clothes kept constantly damp and evaporating. When portaging past rapids, constant watchfulness is needed to make sure that no bundle gets dumped out in full sun. The general practice of covering all baggage on board an open *curiara* with a large tarpaulin or plastic can create intolerable heat underneath, and the plants should be kept separate where they can be inspected, handled and otherwise wet- or dry-nursed at all times. Their position on the craft should be pre-selected with care and they should then be loaded last of all to

Transport of cold-climate orchids along hundreds of miles of hot country roads always presents a problem. There is no satisfactory way of carrying large plants, like the *Epidendrum paniculatum* alongside the car. For average plants, protection is provided by the wooden boxes such as on the roof rack. These have plastic lining on bottom and sides to prevent excessive dehydration, and the roofs are double with an air space to provide insulation.

avoid any chance of their being crushed under some heavy load. *They* are now the privileged VIP passengers: day and night their comfort comes before all else, and if the boat sinks, the true orchid collector will be holding his orchids aloft as his own head disappears beneath the wave. ◆

ORCHIDS IN THE FAMILY

(*Continued from page* 35)

To look back at that terrible summer so dispassionately and even with some humor (however bitter), belies the very real anguish of so many of us who adhered to the edicts from on high while still trying to maintain an adequate watering schedule. In our house, soap had a way of disappearing from the shower enclosure and no one took a shower unaccompanied by a few buckets to catch the water, an occupation considered by at least one member of the family to be asinine and undignified. This unreasonable attitude led to the installation of two large, plastic garbage pails in the hall closet for the collection of rinse water from the washing machine, conveniently adjacent in the kitchen.

At this writing, all the orchids are in the greenhouse; the buckets are sandbox toys; the garbage pails are filled with garbage; the stainless steel butcher trays are marvelous for cooking; and babies number one and two are off to visit the California grandmother for a month. Quo vadis? ◆

HISTORICAL ASPECTS OF ORCHID CULTIVATION

Merle Reinikka

THE science of orchidology reaches back to the classical beginnings of botanical inquiry, but the records of orchid cultivation in Europe and on the North American continent are surprisingly recent. Until the early nineteenth century, there is little evidence of horticultural interest in these plants. Even then, as orchids became increasingly popular and, in response, many plants were shipped to England, the number of species being grown successfully remained pitifully small.

The prevailing thought during that period was that orchids were inhabitants of hot, steaming, tropical jungles. Therefore, to duplicate these conditions as nearly as possible, gardeners devised a hot treatment for orchids without realizing that in tropical countries there could be found climates as cool as that of England. They placed the plants in "stoves"—combinations of densely painted glass, coal fires and hot brick flues. There were no movable windows, hence there was no ventilation. The bricks were constantly drenched; the result was a sickeningly steamy atmosphere. The plants were generally potted in rich loam or rotten wood and plunged into beds of wet tanbark. Under these conditions orchids succumbed by the thousands, until Sir Joseph Hooker, Director of the Royal Botanic Gardens at Kew, aptly suggested that England had become the "grave of tropical orchids."

Despite the rapid mortality rate, plants were imported in larger and larger quantities. The exotic beauty of the flowers, produced by the comparatively few plants that survived a blooming season or two, so stimulated the desires of hobbyists and gardeners that adventurers, seeing an easy means of capitalizing, rushed off to South America and completely stripped many areas of all the orchids they could find. Although some collectors sent growing instructions with their plant shipments (going so far as to send the plants still attached to the very limbs from which they were collected), the growers persisted in their "stoves," and plants continued to die.

A number of commercial nurserymen hired plant explorers and collectors to travel into the tropical regions of the world where they might locate large sources of species which had already become popular as pot plants and to collect new species which might stimulate further orchid interest. The mania for possessing orchid plants caused prices of all available new plants to skyrocket. Great auctions were held in Liverpool and London in which $500 for a single plant was not unusual. Some particularly rare specimens brought a near top price of $2000, which was considered an "investment." Famous hobbyists, wanting their names perpetuated in the annals of botany, freely bid against one another in the hopes of finding new species which might be endowed with their names.

Sir Joseph Paxton, working in his experimental English cottage garden, was the first orchidist to abandon stoves. He opened his greenhouses to the air and sunlight, giving his plants cool, buoyant atmospheric conditions—and they began to thrive. From his observations he formulated a set of rules which demonstrated that most orchids could be acclimatized and conditioned if the proper conditions were afforded. Through his observations and practices, Paxton standardized orchid culture, and Dr. John Lindley, the dean of orchidists at that time, exclaimed: "The success with which they [orchids] are cultivated by Mr. Paxton is wonderful. The climate in which this is effected, instead of being so hot and damp that the plants can only be seen with as much discomfort as if one had to visit them in

an Indian jungle, is as mild and delightful as that of Madeira."

The first nursery devoted largely to the culture of orchids was founded in 1820. Located south of London, the firm of Stuart Low (Benenden) Ltd., Jarvisbrook, was begun by Mr. Hugh Low, who operated it as a general nursery for choice greenhouse plants. The firm is still in existence, having been managed by succeeding generations of the Low family for nearly 150 years.

In May 1841, an orchid show was staged in the gardens of the Royal Horticultural Society in London. As far as records indicated, this was the first orchid show staged.

The Royal Botanic Gardens at Kew, England, were involved with the cultivation of tropical orchids from their beginning. Started as a nine-acre garden in 1759 in the grounds of the Dowager Princess of Wales, for 82 years it remained a private garden. In 1768 the Gardens were known to contain 24 species of orchids, two of which were tropical. By 1813 they contained 46 tropical species and about twelve more from Australia and South Africa. Nearly all these plants were lowland tropical or terrestrial species, for few epiphytic species—particularly the laelias, cattleyas and odontoglossums from the tropical highlands—could survive the then prevailing methods of cultivation.

Mr. John Dominy, of the Veitch Exotic Nursery, Chelsea, England, was the first on record to produce a man-made orchid hybrid. At the suggestion of a friend, Mr. Dominy began hybridizing cattleyas in 1853. About this time he also made a cross between *Calanthe furcata* and *Calanthe masuca*. He sowed the seed in 1854, but it was not until the resulting hybrid, *Calanthe* Dominyi, flowered on October 28, 1856, that orchid hybridizing was considered successful. It created an immediate sensation among orchidists. It was a disturbing situation to the taxonomists, however. Dr. John Lindley, on seeing the new hybrid, exclaimed, "Why, you will drive the botanists mad!" Meanwhile, the cattleya seedlings thrived and in August, 1859, five of them were shown in flower in London at a meeting of the Royal Horticultural Society.

Dominy's success in orchid hybridizing was encouraging to other growers. As a result, the number of orchid hybrids began to increase, and with them came an increased need for establishing rules of nomenclature. In other horticultural fields it had been the practice to give individual seedlings or clones individual names. This system was not adhered to for orchids. In the beginning confusion was rampant, for divisions and clones held by different growers were known by different names, and multigeneric hybrids were often named for only one of the generic parents.

Though often faulty, records were started early in the history of orchid hybridization; probably no other family of flowering plants is so well documented as is the lineage of orchid hybrids. At present, the registered hybrids exceed 75,000 in number.

For more than thirty years the English orchid growers were the only successful hybridizers. Mr. Dominy, in fact, led the field during that time. Hybrids were made between many different species and various genera, the interest being more in finding out simply if certain species or genera would cross rather than with any hybrid goal in mind. This was natural enough, since future progeny could not even be imagined until the rudimentary behavior of orchid hybridizing was determined. New crosses were later developed in France, Belgium and elsewhere. Success was often exceeded by failure, but from the very beginning of orchid hybridizing, records were maintained.

In 1859 the Royal Horticultural Society instituted the First Class Certificate for orchids of great excellence, the chief emphasis at first being to recognize the fine forms of the species. Later, in 1888, to give value to the new products of hybridizing, the Award of Merit was established for orchids which showed sufficiently distinct advances over their predecessors.

On May 12 and 13, 1885, the first

Robert L. Nay

This butterfly orchid is normally a combination of bold yellow and brown, but in this selfing from the rare variety *Oncidium papilio* 'Latour's', the flower is a ghostly yellow. When the species was first imported into England from Trinidad in the 1820's, it fascinated the Duke of Devonshire, who was one of the earliest of the amateur collectors to send explorers into the tropics.

orchid conference was held in South Kensington, England, under the sponsorship of the Royal Horticultural Society. It featured an address by Professor Heinrich G. L. Reichenbach of the Botanical Institute of Hamburg, Germany. The program consisted of two major talks and subsequent discussions: "Hybridization of Orchids" by Harry Veitch, and "Cultivation of Orchids" by James O'Brien.

Few 19th-century continental orchid hobbyists would share the secrets of their cultural methods with their contemporaries. Competition in orchid growing was often violent and jealous, for the few who were fortunate in keeping their plants alive and flowering were regarded with envy. The popular opinion was that orchids were mysterious, and these secretive practices seemed to support that idea.

The early history of orchid growing in the United States consists primarily of reports of collections on private estates or of orchids grown by hobbyists on a limited basis. The first orchid hobbyist of record in the United States was Mr. John Wright Boott of Boston, Massachusetts, whose brother in London sent him his first orchid plant in 1838. The first large-scale production of orchid plants was for the purpose of supplying them to private collections. Commercial growers sent collectors to foreign countries, then imported the collected plants, propagated them, and grew them on for sale.

One of the oldest orchid nurseries in the United States was established by Mr. Fred Sander of St. Albans, England, in Summit, New Jersey. This nursery, however, proved too far removed from England to operate with facility, so it was sold to John Lager and Henry Hurrell in 1896. By the 1890's there were seven commercial firms growing orchid plants for sale and cut-flower production in the United States.

The organization of the American Orchid Society in 1921 by a group of prominent amateur, private and commercial growers, most of whom resided along the Eastern Seaboard, brings us to the beginning of the present era of orchid interest in the United States—an era that has seen the AOS membership grow from less than 100 to more than 11,000 individuals. Recent accomplishments and current avenues of investigation in orchid culture indicate that we have merely scratched the surface and that remarkable orchid history is now being made. Speculating ahead, it is likely that we stand at the threshold of great orchid achievement. ♦

DISCRETION AND RESTRAINT IN THE EXPANDING ORCHID COLLECTION

Rebecca Tyson Northen

SINCE orchid growing is a hobby that knows few bounds, and since orchids have a way of creeping into one's affections, it is difficult to practice discretion and restraint. At first one finds oneself going wild over all the lovely species and hybrids to choose from, and the space in the new greenhouse will look limitless.

You may think that I am going to advise you to decide right away what you are going to grow and stick to it. But how can anyone know now what he is going to like best, or with what kinds he will be most successful? With orchids, one's first love may not be the last. In fact, most of us develop many loves. Some we may regretfully have to give up as new ones come along; some we may never be able to part with even though our interests expand and become more sophisticated.

Next to fine things for themselves, orchid growers like to share with others, and they are particularly anxious to give a beginner a start. You will be quite overwhelmed at the generosity of friends who insist that you accept a division of this or that, and at the quality of their gifts. And you will find irresistible many things you see in catalogues. Even though you begin to realize that your benches are overflowing you will order "just a few" seedlings or "just a couple more" species. It will hurt you to see the heap of things a neighbor is throwing away and you will feel you must take them home, against his advice.

Wherever you go you will hear orchid growers commenting to each other, "I can't seem to make this kind do well for me, while a friend of mine has them flowering all over the place." As strange as it may seem, there is a kind of affinity between some persons and some plants, something to do with talent or touch. The difference between what does well for one grower and another also has a lot to do with actual conditions in their separate greenhouses or windowsills, and even more to do with individual ingenuity. This last is a clue to most of what has been learned about orchid growing in the past hundred years.

If you crowd your greenhouse with an indiscriminate group of plants, you are going to learn a lot in a hurry. Some of it will be good, some painful, and some may be disastrous. I would like to make a few suggestions to help forestall some of the pain and disaster. But I must admit that there is great value in learning things by oneself. It is exciting and deeply satisfying to work out the solution to a problem, and you may discover something that the rest of us can use! Besides, if you look into the greenhouses of some of us old-timers, you will undoubtedly see that we can't always keep from having too many plants either, and that we, too, have kinds that do not cooperate with our efforts.

Overcrowding is perhaps the chief problem for all orchid growers. Seedlings grow to adulthood, big plants give many divisions, and the things we order, or bring home, or collect in the wilds take up more space than we thought they would. Thus there are soon plants shading each other, new growths becoming entangled with those nearby, and flower spikes without room to display their blooms. Not only that, but air circulation is reduced, diseases are encouraged, and insect pests find places to escape notice. Plants can be damaged and lost.

Some people can put up another greenhouse whenever this point is reached (some who "can't" do so anyway), and

All photographs by the author

THE LURE OF ORCHIDS

A—Everyone enjoys the "rubber doll" on the lip crest of *Odontoglossum grande*. B—The quarter-inch flowers of *Ornithocephalus bidentatus* reveal a column that looks like the head of a duck. C—Tiny *Oncidium pusillum* produces its jewel-like flowers one after another for months on end. D—*Cycnoches aureum* is a dainty cousin of the familiar green swan orchid. E—The much reduced petals, lip and column of masdevallias nestle at the bottom of a tube formed by the fused sepals. This is *Masdevallia reichenbachiana*. F—Press the tail-like trigger of catasetum and the pollinia will shoot out and stick to your finger. This is *Catasetum oerstedii*, also known as C. *integerrimum*.

the windowsill growers expand into greenhouses. This is the way many a small start has grown into an all-absorbing interest, and even into a business.

Whether you can add to your growing space or not, it is wise to become discriminating, for it serves no purpose to multiply poor plants. First of all, you may find that those plants you brought home from your friend's trash pile were wisely destined for discard, and you will oust them yourself. (Please do your neophyte neighbor the favor of putting them in the garbage can when he is not around to re-rescue them.) Next time you are tempted, consider why the grower is discarding the plants. If they give poor blooms or look diseased, don't take them, no matter how alluring their names.

Among plants you acquire in other ways, perhaps as seedlings, keep only the good ones and throw away the poor ones. Trying to nurse along the latter only takes up space you could devote to more interesting things. However, a few words of caution: Some seedlings take an unusually long time to mature, so give them a chance as long as they increase in size and are healthy. If things look sickly, ascertain whether they may be suffering from something you can cure before tossing them out. You will read elsewhere about diseases and pests, overwatering, etc. Plants collected in the wilds sometimes take a long time to become established. I have two which sat in their pots doing nothing for three and four years respectively—their pseudobulbs remained plump and hard, they just didn't grow. Finally, both have sent up new shoots and are merrily growing along.

You will appreciate the world of orchids more if you do not limit yourself to one kind. After all, the chief attraction of orchids is their infinite variety. You will learn that each prefers certain temperature (especially night temperature), light and humidity, and that you will do better to grow together those that have similar needs. Perhaps a greater variety can be grown in an intermediate greenhouse (night temperature 55° to 60° F.) than in a warm or a cool one. With a little experimenting in placing marginal plants, you can find spots they will like. In an intermediate greenhouse you can have species and hybrids from *Oncidium, Epidendrum, Miltonia, Cycnoches, Vanda, Dendrobium, Paphiopedilum, Odontoglossum, Laelia, Cattleya*, miniature cymbidiums, and many, many others. I don't know how they do it, but some growers also have luck with phalaenopsis along with these Nowhere, I believe, do phalaenopsis grow as luxuriously as in a naturally warm, humid climate. The opposite is true of the big cymbidiums. People have worked their hearts out trying to make them flower in warm climates, but it can be done only occasionally. Perhaps the victory is worth the battle for those who are willing to spend so much time and effort. From the several genera listed above for an intermediate greenhouse, you can find species that come from lower or higher elevations that will do well in a warm or a cool greenhouse.

Eventually, you may find one group so appealing that you want to specialize in it. How much better it is to come to a specialty after learning to grow and love many kinds! You will have a richer background, for one thing, and you will have far more understanding for the preferences of other people. Not always do those who grow only cattleyas or cymbidiums sympathize with those whose chief delight is the odd little wild orchids that one sometimes has to use a magnifying glass to see. And those who may have a hundred or more species may think life awfully dull for those who have only hybrids of one or two genera, not realizing the intense study that goes into the breeding and inheritance of the hybrids.

Really, though, it is my personal feeling that a collection is much more interesting if in addition to your specialty you have some of the other fantastic, serenely beautiful, and oddly funny species to add variety. How much more exciting orchids will be if you can wake up one morning to find that the fat buds of a stanhopea

(*Concluded on page* 72)

CAN ORCHIDS BE GROWN FOR PROFIT?

James Wilkins

WHAT amateur horticulturist hasn't nourished the dream of retiring to the Sunny South and setting up an orchid business? He could do the thing he would love most to do, and might become wealthy beyond imagination! This is of course a pipe dream—not totally impossible, but improbable.

Before anyone ventures into the commercial orchid world, particularly the cut-flower business, he should take a good hard look at the tastes and appetites of the consumer in the region in which he has chosen to live. The popular flower might be cymbidiums, which in many areas will not bloom. In southern Florida, there are so many amateurs selling certain orchids that prices are quite low. In areas where the competition is less fierce, the problems may be different, but they are just as serious. The legendary difficulties of selling in a big flower market are a sad reality when they face the small producer. Orchid flowers are priced according to standards, but the standards are in the eye of the beholder—a judgment that buyer and seller seldom share. The wonderful box of white cattleyas (according to the seller) delivered at the height of the bridal season may be the same second-quality box of flowers (according to the buyer) usable only for funeral wreaths, and the final authority in the small cut-flower business is usually the buyer.

With an eye to the future, it seems that the prospective flower producer will have to set up business on a production-line basis. This means, in other words, that he should buy his stock so that he will have a certain number of flowers opening on specific dates. It is now possible to do this by selecting a group of meristem* plants of a given clone which are identical and which will flower on nearly the same day.

Color also plays an important role in choosing one's stock. Right now it rather looks as if white is the safest, as it can be dyed any color to suit the occasion.

Another possibility, and an important one, is that of growing seedlings that appeal to the hobbyist. Here the grower must prognosticate the tastes of four or five years hence and buy his stock accordingly. Nothing is more dead on today's market than last year's winner.

The problem for the backyard grower is that customers may arrive at any given moment. Sometimes hordes of people show up with their noses pressed to your living-room window. At times it may seem very confining, but for the orchid hobbyist to travel some distance and find the owner out would constitute a crime on the owner's part. Weekends are most convenient for the potential customer, so to be a successful backyard grower you must accommodate yourself to this circumstance.

If this is not to your taste, then you must turn to mail order selling. Trade magazines are numerous, and lists of orchid buyers are available. This type of merchandising relies partly on the ability of the owner to write spell-binding copy and partly on his ability to produce and deliver the goods.

Another type of business, perhaps where most dealers begin, is the importing and selling of "botanicals." It seems that there are endless numbers of orchid species, and for some reason, or perhaps for no reason, each year a certain few will fall into favor. Selling these can be done successfully as a mail order business, but it usually means that the plants

(*Concluded on page* 59)

*See page 58.

GILDING THE ORCHID

Special devices for potting and displaying increase a plant's attractiveness

H. Phillips Jesup

ONE of the more frequent comments from people who view orchids is, "The flower is gorgeous, but the orchid *plant* is so homely!" The word *plant*, of course, refers to the vegetative portion. From the standpoint of foliage characteristics or grace, this is indisputably true of many types, and one's attitude must be that the starkness or stiffness of the growth habit enhances the opulence of the flowers by dramatic contrast. There are exceptions in certain genera, such as the mottled-leaved paphiopedilums (more commonly but incorrectly known as cypripediums), dichaeas, haemarias ("jewel orchids"), and a number of lesser known types, many of them dwarf in stature.

A rectangular clay pot adds a note of interest to this 6-inch-high monopodial orchid (*Ascocentrum miniatum*) from southeastern Asia. Blossoms are brilliant orange-yellow.

Robert E. Hurwitz

Ted Dully

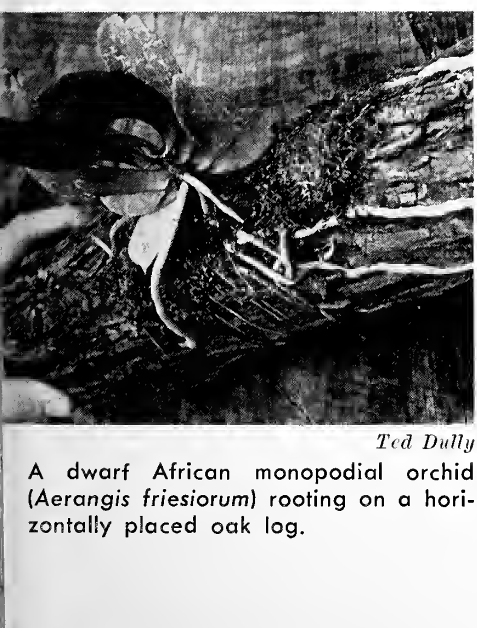
Inch-long maroon and cream-white flowers of a miniature Jamaican oncidium, *O. triquetrum,* are displayed to advantage from a hanging pottery planter of unglazed clay. Ample drainage holes (shown) are important.

The completely understandable concern with the appearance of orchids during their off-season has surprisingly seldom led to action by American orchid growers to enhance the appearance of their plants through imaginative artistry in potting or mounting, or through pleasing, artistic arrangement of their greenhouses. Probably this stems from a variety of factors. The major emphasis of the newly enamoured is usually on cultural requirements, and it really is sensible to learn to grow the plants in more conventional containers at the outset. The preoccupation of the seasoned orchid hobbyist, as distinguished from the more casual grower, is with the plants themselves—their rarity, fine points of difference in flower

quality, as botanical curiosities—and this frequently leads, it seems, to their subordination as objects of beauty.

There is much room for work with orchid plants to enhance their appearance, and the limits are the extent of one's imagination and one's understanding of the fundamentals of orchid culture. I have intentionally omitted as a limit cultural requirements themselves, since modifications of treatment can be devised to cope with nearly all arrangements. To use a ridiculous example, an orchid growing on a broom handle (not a difficult feat if the plant is small and tightly tied until established) would simply require frequent wetting (probably daily, even for those species which naturally grow under rather xerophytic conditions), and very frequent applications of a dilute fertilizer.

Possibilities are legion. One of the more obvious approaches, although very seldom exploited, is to capitalize on one of the more fascinating characteristics of the majority of tropical orchids: their existence as epiphytes, clinging to the limbs of trees. Somehow, if all orchids grew as herbaceous terrestrials, they would seem more prosaic, less exciting; and a pot tends to dispel the epiphytic concept. An orchid growing on a natural section of a tree limb conveys the proper



Ted Dully

A dwarf African monopodial orchid (*Aerangis friesiorum*) rooting on a horizontally placed oak log.

Ted Dully

Cinnamon-brown and yellow flowers of *Epidendrum belizense* arch gracefully from a section of sassafras limb.

sense of drama, and for those species particularly opposed to wet feet, such a mounting provides the ultimate in drainage. Most rough-barked trees seem to be satisfactory, although one hobbyist has warned against willow and black walnut. I have used white and black oak, dogwood, Tatarian honeysuckle, sassafras, black locust, sweet gum, lilac and others successfully. The key, as in all mountings, is to tie the plant so it cannot wiggle before roots have gripped the bark. The equipment I use consists of nylon fishing line to tie the plant, eye screws to use as feet if the log is to sit horizontally on the bench or to be screwed into the end if it is to be hung vertically, and a hand drill to make a hole for the hanging label wire as well as for a wire hanger if the log is to be hung against something. A tightly tied and neatly trimmed pad of osmunda or sheet moss (living, preferably, for continued verdance) is useful to preserve moisture in certain situations or for some species. With sufficient water and food, most epiphytic species thrive on limbs and

vigorously send forth roots, which are much longer lived than when subjected to less than perfect drainage and aeration in pots. Be sure to cut your limbs or trunks from living trees; a log filched from the woodpile may be well on the way to rotting, and the orchid may have to be remounted prematurely.

Rarely seen nowadays in orchid collections are orchid baskets made of cypress or redwood; these too make an orchid look like an orchid and are fine for growing nearly all types, either hanging or on the bench. If you pot in fir bark or one of the mixes, use a liner of sheet moss or plastic screening. It is easy, too, to cut sticks, drill holes (again that drill is useful) and make your own rustic baskets in odd shapes and sizes for aesthetic effects and practicality.

Decorative pots, particularly of unglazed clay, go far toward relieving the boredom. English style pots or odd shapes, such as rectangular, are effective and are fun to search for. Glazed pots, while they can be strikingly effective, must be watered with care and flushed frequently to prevent build-up of fertilizer salts. Plenty of crock for drainage in glazed pots is wise, and it is perhaps best to use only orchids tolerant of fairly damp conditions at the roots. I should

Peter Maronn

From a mossy limb in the highland cloud forests of Costa Rica to a dark blue glazed hexagonal pot in a Connecticut greenhouse, 8-inch-high *Epidendrum endresii* has made the transition well. The lavender-blue and white flowers last with perfection for two months.

mention here the Japanese, who have traditionally grown orchids in such decorative pots and also, in general, for the effect of the whole plant rather than the bloom alone.

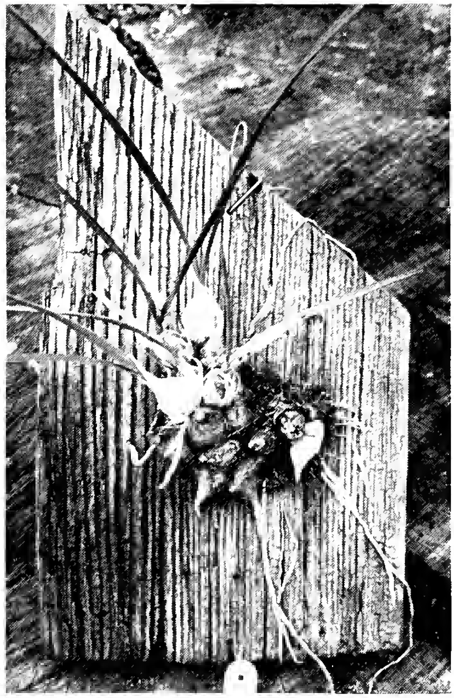
Groups of plants can be educational or generally significant as well as attractive. For instance, several years ago I attempted what has proved to be a quite successful miniature landscape using a composite of the charming white angraecoid species *Neofinetia falcata* from Japan with several of its dwarf hybrids ranging from orange to tan to rose pink. Thus far I have not achieved perfection in inducing all to flower simultaneously, although each year I seem to get closer to my goal as the hybrids increase in age and flower several times a year. Components of groups should of course have similar cultural requirements. A very

Growing on a moss-capped block of redwood is the elfin orchid *Pleurothallis grobyi*, accompanied by a resurrection fern. Nylon string holds plants tightly until roots clasp the wood.

Ted Dully

Ted Dully

A 6-inch open basket holds *Promenaea Crawshayana*, a cool-growing hybrid produced in England in 1905.



Ted Dully

Onion-like pseudobulbs of *Epidendrum microbulbon*, a Mexican species adapted to dryness, are mounted here on a slab of weathered wood from an old barn.

In or out of flower, *Spiranthes adnata* is attractive any time of the year in a shallow clay pot, with plant placed off-center on a mound of moss.

H. Phillips Jesup

effective ploy is to mass a number of plants of a single species or hybrid on a branch or other support, thus creating a spectacular mass of bloom in season, particularly intriguing if the species happens to be a variable one. This is a worth-while aftermath of a collecting trip, but companions in a community pot are just as good candidates.

While the presence of individual plants dealt with imaginatively makes one's greenhouse more interesting, why stop there? A windowsill collection particularly should be made attractive. An entire greenhouse can be transformed into a showcase of aesthetic as well as utilitarian value by thoughtful placement and display of the plants, perhaps with a small pool as a focal point, to create an overall scene of interest and beauty. ◆

Happiness is .....
ARRANGING ORCHIDS

Mrs. Truman Green

TO write of flower arrangements without mentioning the elements and principles of design is almost heresy, but this article is only about the use of orchids and how beautifully they function as the featured flowers in designs for all occasions.

There are dwarfs and miniatures to outshine jewels for earrings, clips, charms and such ornaments, or for dainty small or miniature arrangements. For corsages, there is a size, a color or a form to fit the person and enhance an outfit for any time, day or night.

Nature formed graceful linear patterns in the arching sprays of phalaenopsis; in the strong ascending scapes of arachnis; in the branching panicles of renantheras; in the charming lines of the "dancing ladies"—the oncidiums; in the sprays and stalks of the epidendrums.

Far lovelier than bunches of grapes are the pendulous inflorescences of the Indian and Burmese dendrobiums; the hanging racemes of most of the gongoras and stanhopeas; the semi-pendent scapes of cycnoches, acinetas and catasetums; the drooping racemes of aërides and coelogynes; the full "fox tail" fall of rhynchostylis and the saccolabiums.

The "florist orchid"—cattleya and its allied genera—provides a target form for all periods of floral design. This tribe is dazzling in its variety, from the showy multi-flowered clusters of *Cattleya amethystoglossa* to the distinctive single-flower-on-a-stem *Brassavola digbyana*; from the pristine pureness of *Cattleya intermedia alba*'s whiteness to the warm brilliance of *Cattleya aurantiaca*'s red-orange.

Satisfactorily long lasting, colorful and excitingly varied are the heavy-substanced, bright-textured vandas and cymbidiums. They, along with the lovely

Lewis Ellsworth

Dendrobium stratiotes and Vanda Eisenhower, in shades of yellow, in the top of an antique bronze incense burner.

odontoglossums, may be used on their many-flowered stems simply as flowers in a vase or old-fashioned bouquet, just as they are in period arrangements, or the individual flowers may be taken from the stem and wired for special placement in interpretive design.

Strange, mysterious, intriguing, fantastic, fascinating and spectacular are

some of the descriptive adjectives that could be applied to the angraecums; to *Cirrhopetalum fascinator* and *C. medusae;* to *Masdevallia bella* and *M. veitchiana*; to *Catasetum fimbriatum* and *C. pileatum*; to *Bulbophyllum lobbii* and to scores of other orchids that inspire the floral artist. These blooms are singularly appropriate for the Avant Garde, the Free Form, the Abstract—the "way out" interpretations peculiarly suited to this Jet and Space Age. One can think of spider webs, sorcery and witches' brew with certain of the brassias, while most of the bulbophyllums have all the attractions of the scent of sin. In the virginal freshness of white phalaenopsis, of *Chysis bractescens,* of *Peristeria elata,* of *Lycaste skinneri,* one can see the spirit of first love and innocence . . . and one can envision spring forests and mosses and streams with the stately paphiopedilums.

Great personal expression or distinction may be attained in modern design with **accent** on the brilliant and vivid: *Disa grandiflora,* most *Sophronitis* flowers, *Masdevallia veitchiana, Gongora quinquenervis, Maxillaria nigrescens* or *Paphinia cristata* . . . or with **emphasis** on the subtle: muted *Miltonia spectabilis* or pastel prettiness of *Laelia rubescens.*

Contrary to popular belief, most orchids are fragrant, some so highly that one can perfume a whole house by their use. Among them are *Brassavola nodosa* and *B. digbyana, Cattleya citrina, Dendrobium moschatum, Lycaste aromatica, Aërides odoratum, Epidendrum fragrans,* just to name a few. The arranger can select the scent that most nearly matches the mood of a design.

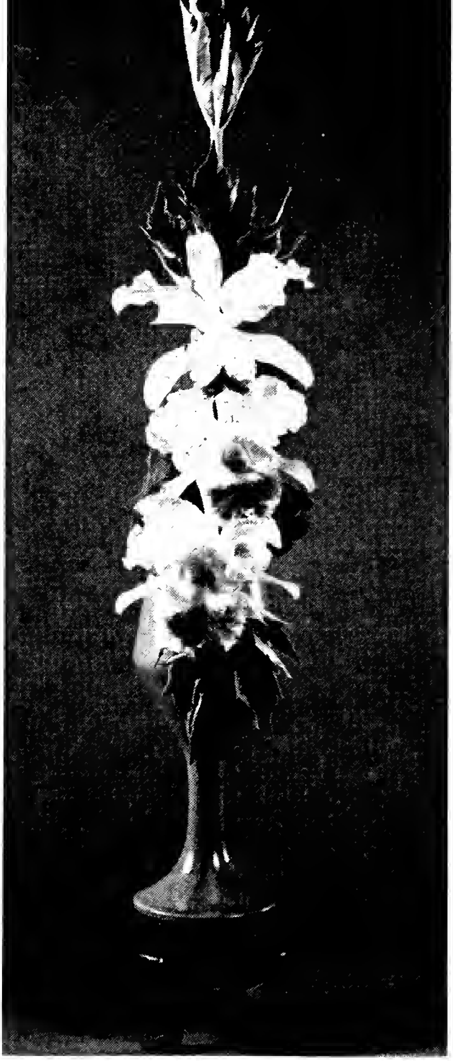
Floral artists inexperienced in the use of orchids usually think only of the single-flower cattleya type which they see at florist shops, and which they consider difficult to arrange because of their short stems and dominant labellums. They need not fear! Dentists are obliging with empty novocain tubes, which can be filled with water and wired and taped on stems. Floral supply houses offer an assortment of tubes and caps, including tiny plastic tubes that come in various orchid colors and a hollow-stemmed one that may be fitted onto picks or stems. Besides, many orchids, when properly conditioned, will last for days and sometimes weeks out of water. (A number of General Patton cattleyas in a Christmas door swag lasted outside in Tampa, Florida, from December 15 until January 1 before getting a bit rusty at the edges. *Vanda* Eisenhower blooms in a special theme arrangement on a hall table lasted from February 11 until February 27 before they showed loss of substance and dimming of color.)

At the right stage of development (full maturity), orchids should be cut with a

Orchids provide a chance for dramatic textural contrasts, here between the fragrant, fringe-lipped *Brassavola (Rhyncholaelia) digbyana* in soft lime-green and white and the thorned edges of the leaves of *Bromelia pinguin,* which have rich green tips and scarlet heels.

slanting stroke by a razor-edged knife. Cattleya types should be placed with their stems in at least an inch of water and let stand for an hour or two before refrigeration at about 50°. The heavy, cluster-type cattleyas such as *C. amethystoglossa* and *C. granulosa* should be conditioned along with vandas, cymbidiums, paphiopedilums, phalaenopsis, dendrobiums, aërides, arachnis, oncidiums, etc., by complete submersion in a tub of water. Let them soak for home use from 2 to 12 hours and for public demonstrations and shows from 12 to 24 hours. If these soaked orchids show signs of droopiness or wilt, they may be taken from the design and dunked again for revival. Reed-stem epidendrums, schomburgkias and renantheras behave quite well if cut and placed in a pail of water and set in a cool, still place until needed for use. Wisps of damp cotton should be taped on the stem ends of individual blooms before wiring and taping for use in a design. The extra taping helps preserve moisture and protect sometimes fragile, tender or brittle stems.

To achieve harmony of line, color and form in orchid arrangements will take some practice. Color "spottiness" may be



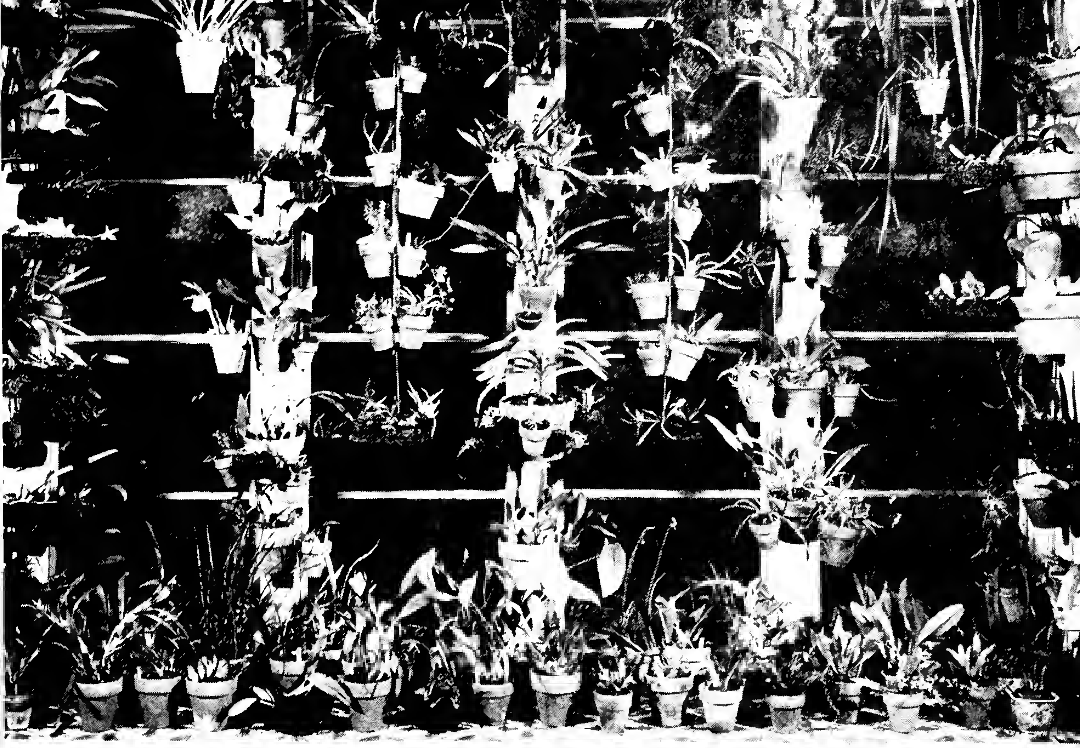
Lewis Ellsworth

Vertical arrangement of a semi-alba cattleya with rice-paper-plant foilage.

An arrangement of purple spikes of liatris and lavender gladiolus, with light to dark lavender *Dendrobium phalaenopsis* and cattleya orchids.

Anthony Lopez

eliminated by placing orchid lips in the same line direction and in near proximity to achieve transition and a rhythmic flow of color. Where vines, branches or other kinds of foliage are used with orchids, they are more pleasant and appropriate if they are of strong character, as can be provided by strelitzia, sago, aspidistra, dracaena, loquat, bromeliad, carissa, orange, manzanita, fig, magnolia, etc. For "quickie" arrangements, several background patterns made up of fresh, dried or painted materials ready for the addition of orchids are a great help. ♦



George Kline

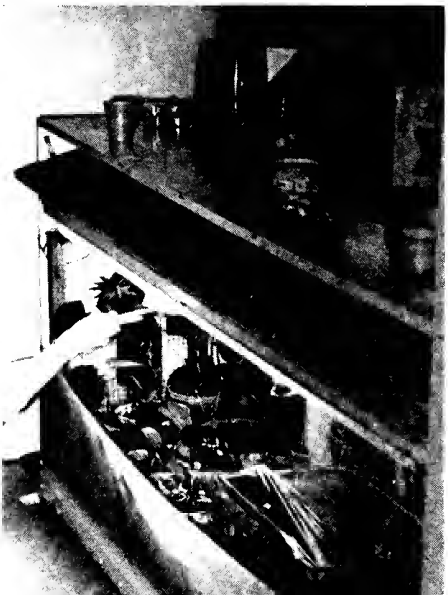
Dining-room bay window with tiled sill serves to grow this unusual collection of about 150 miniature orchids. Most of the plants were summered out of doors.

Peter K. Nelson

Part of the Brooklyn Botanic Garden's conservatory display of orchids. ►

Carl L. Withner

Orchids in place of pots and pans in a kitchen cabinet. ▼



PROPAGATION BY "MERISTEMMING"

Production of mericlones from growing point a new and revolutionary technique

Merritt W. Huntington

THE past few years have seen a virtual revolution thrust upon the orchid enthusiast. Neither the avid amateur grower nor the large commercial flower producer can escape the meristem revolution.

Georges M. Morel, noted French plant physiologist, first discovered in the late 1950's that it was possible to secure virus-free cymbidiums by aseptically cultivating the apical meristem (growing point) of a cymbidium. The first publication of interest to orchid growers appeared in the *American Orchid Society Bulletin* (July 1960). Unfortunately, it was given little attention by American growers.

The meristem subject lay practically dormant until June of 1964 when, almost simultaneously, Morel published a further article entitled "Meristem Tissue Culture of Orchids" and the French firm of Vacherot & Lecoufle announced at the annual meeting of the National Orchid Growers Association in the United States that they were prepared to "meristem" on a commercial basis.

Morel's work had shown that the growth of the apical meristem of the orchid was very similar to the growth of the embryo from the orchid seed. Each produces a protocorm.* It is then possible to subdivide these protocorms and continue this dividing and subdividing until the desired number of protocorms have been procured. Then they may be transferred to a growing medium and allowed to grow and produce leaves and roots.

This newly developed method of producing untold numbers of any orchid clone will undoubtedly cause many changes in the orchid industry. The first and possibly finest benefit from clonal reproduction by the meristem method is that virus infection, anathema of the commercial grower, can be eliminated in cymbidiums. The elimination of virus in the other orchid genera is not possible at this time, but it assuredly will be very soon.

What does this mean to our avid amateur and commercial flower producer?

It means that in the short period since the commercial production of mericlone plantlets was started, many hundreds of clones have been "meristemmed." The amateur may now include in his collection many of the heretofore priceless plants that were unobtainable. A prime example of this is the much sought *Sophrolaeliocattleya* Falcon 'Alexanderii' FCC/RHS-AOS, which has been priced at about $500 per plant. The mericlones are now available from $5 to $10 each. This example may be repeated hundreds of times, as commercial orchid growers are now advertising mericlones of several hundred different clones, including many awarded ones.

How does one choose a clone for meristemming?

To date there appear to be two types of plants being meristemmed:

First, those that are rare, usually awarded show plants that have commanded a high price and have been difficult to obtain. These are, for the most part, the reds, yellows and other unusual color forms.

Secondly, and by far more numerous, are those that are the finest commercial cut-

*For a description of the orchid protocorm, see pages 61 and 67.

flower types. Mericlones are enabling the commercial orchid grower to up-grade and up-date his cut-flower orchid plants in a way never before available through the growing of seedlings. The commercial grower can select clones of a desired color and form that flower uniformly at the time of greatest demand. Through this method, he may more nearly produce the desired type in the quantities needed for the varying seasons of the year.

Dr. Morel and Vacherot & Lecoufle have grown mericlones to maturity and flowered them, thus establishing without doubt that they are clonal divisions of the original plant. The first mericlone known to have flowered in the United States bloomed at Kensington Orchids, Inc., Kensington, Maryland, in December 1966. A plant of *Cymbidium* Kurun 'Troubadour' was a perfect reproduction of the mother plant. In April 1967, a group of 31 plants of *Cymbidium* Sea Foam 'Green Fire' AM/AOS were all flowered at one time and each was, as expected, a perfect reproduction of the mother plant. Each passing year and month will bring many more flowerings of mericlones and the current revolution will become just another horticultural advance gained through scientific research. ♦

Robert E. Hurwitz

Five identical seedlings of *Cymbidium* Sea Foam 'Green Fire' AM/AOS obtained by meristem culture of the original clone.

ORCHIDS FOR PROFIT

(*Continued from page* 49)

must first be established in this country. Southern shade houses are perfect for this. An importer also has the great advantage of constantly changing scenery. The prospect of something rare or undiscovered in a heap of newly imported plants holds great fascination for the hobbyist.

The most sophisticated commercial orchidists are "super specialists." They carry one or a few types only, such as yellow cattleyas, red cattleyas, or other equally rare and elusive plants. This kind of growing narrows down not only the necessary space but also the potential market. For the "super specialist" the business is usually more for fun than for profit.

With the foregoing choices and conditions in mind, one's next consideration should be his location, provided he is going to move at all. Climate has a great deal to do with the construction necessary. The southernmost United States—that is, southern Florida, the Gulf States or southern California—permit the use of open-shade houses with lath or plastic screening. With these, the dollar puts many more square feet under cultivation than in the North, but by the same token, one would find these locations well entrenched with competition.

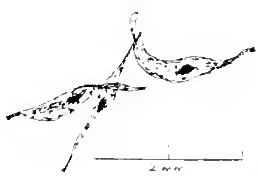
If a person is still serious about eking out his Social Security in a backyard orchid range, he can quickly see that it will not be a fun-type collection that brings home the proverbial bacon. One must have a carefully attended and well-protected range, one that takes time and care to build before the first dollar can be pocketed, and then more time and continued care to maintain successfully. ♦

RAISING ORCHIDS FROM SEED

Simplified techniques have been developed recently

Joseph Arditti

THE first description of orchid seedlings was published by the British botanist R. A. Salisbury in 1804, more than two thousand years after Theophrastus first described what we today consider to be an orchid plant. The variety of false notions that arose in the intervening years regarding the existence, viability and germinability of orchid seeds was undoubtedly due to their exceedingly small size and peculiar germination requirements. Most orchid seeds measure less than a millimeter in length and from less than a tenth to a quarter of a millimeter in width. (There are about $25\frac{1}{2}$ millimeters in an inch.)



Lynn Maxey

Minute seeds of a laeliocattleya orchid.

The embryo enclosed within a membranous, but often transparent, seed coat is even smaller and may at times consist of no more than ten cells. In addition, orchid seeds have little or no food reserves and appear to be incapable of normal metabolism during the early stages of germination. Therefore, orchid seeds cannot germinate readily in nature. In order to germinate they must become infected by a fungus which somehow assists with their metabolism and may even provide certain nutrients and growth factors. This fungus eventually penetrates the orchid roots where it remains throughout the life of the plant. It is therefore known as *mycorrhiza*, meaning "root-fungus."

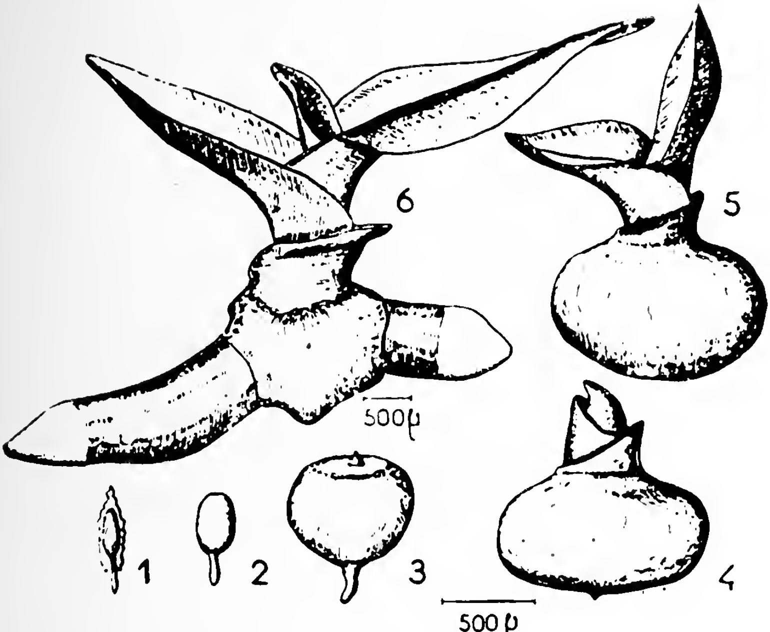
Procedures for orchid seed germination were long unknown in Europe, and for many years growers could replace their stock only through importation or vegetative propagation. However, as orchids increased in popularity during the 19th century, attempts were made to develop practical methods for seed germination and seedling culture. Apparently the first to discover that seeds sown around the base of the mother plant germinated and grew relatively well was a surgeon in Exeter, England, named John Haris. By 1852 the Veitch nursery was using this method, as were growers in France and Ireland shortly thereafter. For half a century this was the only known method of orchid seed germination.

The biological principles which made this type of germination possible remained unknown for many years, since neither the growers nor the scientists of the day were aware of the role played by mycorrhiza in orchid seed germination. This is surprising, because the orchid mycorrhiza was apparently first noted in 1840, positively recognized by 1846, and its existence firmly established by 1886.

The part played by the fungus in germination was, however, not recognized until 1899. The French botanist Noël Bernard and German orchidologist Hans Burgeff, using this fungus, developed the symbiotic method for orchid seed germination. This involved the inoculation of culture tubes with both seeds and fungi. Although this method was a great improvement over the previous technique, germination was erratic and the fungus often killed seedlings. Still, the method was widely used since no better one was available.

The discovery which made large-scale

Research support by the American Orchid Society and the Orchid Digest Corporation have made the writing of this possible. I would also like to thank Lynn Maxey and Robert Knauft for their aid in the preparation of the article.



Drawings by F. Mariat of the Institut Pasteur

1. Seed swollen and green but still covered with seed coat. 2. Embryo has formed a spherule; seed coat is broken and lost. 3. Early protocorm showing pointed vegetative apex. 4. Older protocorm, discoid in shape, showing leaf tips. 5. Plantlet with two young leaves taking shape. 6. Plantlet with two or more leaves and one or more roots.

orchid seed germination possible, and in effect revolutionized orchid culture, was made in the United States by Dr. Lewis Knudson at Cornell University. Combining his own knowledge of the influence of carbohydrates on green plants with previous discoveries by Doctors Bernard and Burgeff, Dr. Knudson reasoned that orchid seeds should germinate well on an agar medium containing a balanced mixture of minerals and sugar. He tested his theories by experimentation, proved them to be correct and developed the now famous and widely used *asymbiotic* method for seed germination. Following his original discovery, Dr. Knudson continued to investigate the problem and in 1946 published his improved and by now well known "Knudson C" medium. Although generally satisfactory for most genera and species, this medium proved not entirely suitable for *Paphiopedilum* (*Cypripedium*) seeds. For these a special medium known as "GD_1" was developed by Detert and Thomale in Germany.

Seed Germination

The asymbiotic method for orchid seed germination is relatively simple, but it requires care and close attention to details. Basically, it involves sowing the seed under completely aseptic conditions on the prescribed agar medium in a bottle or flask. This is called "flasking."* Many

*Those who wish to flask their own seeds may consult an article by the late R. J. Scott and myself, entitled "Cymbidiums from Pod to Pot," in *American Orchid Society Bulletin* 28(11), pages 823-829, 1959, and a further description of the method in *Orchidata,* the publication of the Greater New York Orchid Society, Vol. 7, No. 2, 1967.

orchid hobbyists send their seed to professionals for flasking. When the seedlings become crowded, they are thinned by *transflasking.* When they become so large that they crowd the flask or bottle, it is time to move them to a community pot or flat. This is the point at which most people raising plants from seed acquire their orchid seedlings.

Preparing the Community Pots

A variety of methods and culture media have been employed by various growers. A simple method used successfully by Ilsley Orchids of Los Angeles is to fill a 5-inch pot with coarse fir bark or broken clay pots to within 1½-2 inches from the top. This insures good drainage. Each pot is then filled to its rim with a well mixed, thoroughly moistened, firmly tamped compost consisting of the following:

seedling grade, heat treated, kiln dried fir bark	80-90% by volume
shredded redwood bark or redwood shavings	10-20% by volume
Dolomitic limestone	a full 4-inch pot per 2 cu. ft.
hoof and horn meal	the same

Removal and Preparation of Seedlings

Soften the agar by placing the bottles in body-temperature water for 30-60 minutes. The seedlings can then be easily pulled out with a wire loop. If they are too big, break the bottles. Soak or wash the seedlings in lukewarm water until *all* the agar has been removed. This should be followed by a rinse in a good anti-damp agent (a fungicide) according to the instructions on the package.

Planting the Seedlings

Make a deep hole with a stick about the diameter of a pencil, carefully insert the seedling in it and firm the compost around all the roots. Allow about 1½-2 square inches per seedling, and there probably will be no need to repot until they reach 6 inches in height.

Robert E. Hurwitz

Orchid seed, after being sown under sterile conditions in an agar and nutrient mixture, spends the first year or so of its life sealed off like an incubator baby.

Growing the Seedlings

Place the community pots in a corner of the greenhouse where the light intensity is about 1,000 foot candles. Day temperatures should be about 75° Fahrenheit but no higher than 90° F. and the night minimum not below 70° F. Relative humidity should be around 70 per cent. The young seedlings should be sprayed with a fine mist two or three times a day. Do not water them during the first week. After that, water *carefully,* since over-watering is the most common cause of failure. When young roots appear on the seedlings (usually within two to four weeks), it is time to start fertilizing. Use any of the commercial high-nitrogen soluble fertilizers, either at quarter strength once a week or 1/10 or less strength with every watering. Leach the compost every two to three weeks to prevent build-up of salts. When the seedlings become crowded, it is time to move them to separate pots. Fir bark, Mexican tree fern or Hawaiian hapuu may be used for this purpose. Pack the potting material lightly around the roots, taking care not to damage the roots. Place the pots on a greenhouse bench and treat them as adult plants. Good luck! ◆

Author photos

Seedlings of orchid species which have been selfed at the Singapore Botanic Gardens in an effort to keep the species from dying out.

CONSERVATION OF ORCHID SPECIES

An important role for botanic gardens

A. G. Alphonso

CONSERVATION seems to be the topic of the day among botanists, zoologists, foresters, naturalists and others. Reforestation, nature reserves, forest reserves, national parks and game reserves have helped greatly in conservation of both animal and plant life. However, in the protection of a flora of a country or a region, botanists and foresters seem to give more attention to the trees than to the herbaceous plants. Such plants occur in abundance in the tropics, where epiphytes, ferns, orchids and thick herbaceous undergrowth make up the greater portion of plant life in the rain forests.

The botanic gardens can play an important part in the conservation of such plants. Since most botanic gardens occupy small areas as compared with those of nature reserves, forest reserves or national parks, the work of conservation must obviously be confined to the smaller plants rather than the large trees. For example, the Singapore Botanic Gardens (about 80 acres) will not be able to grow within its boundaries trees representative of Malaysia, but in a small section of the gardens could grow thousands of orchids, ferns and other herbaceous plants representative of the region. The Singapore Botanic Gardens, apart from their primary function as a museum of living plants and their taxonomic work on the flora of the region, are now involved in the conservation of orchid species. Orchids make up a large part of the flora of the tropics, and Malaysia is no exception. Unfortunately, they are fast being depleted

Neuwiedia veratrifolia, a native orchid now difficult to find in Singapore.

and destroyed in the areas where they naturally occur. In Malaysia, the clearing of vast tracts of forests as a result of the expansion and progress of a modern society has resulted in a large number of orchids, both terrestrial and epiphytic, being destroyed. Orchid species are in great demand by commercial growers and nurserymen. High prices have been paid by them for species with the result that jungle areas, scrubland, swamp forests, river-banks, rocky seashores, limestone hills and many other localities where orchids occur, have been visited by collectors and indiscriminately stripped of the species. If, after they have been collected, these species are well handled, propagated and multiplied, then such action in itself would be a form of conservation, but unfortunately most of them are killed through neglect and careless handling. By the time they are brought to their destination and sold to orchid growers, weeks have elapsed, and during this period a high percentage of the plants perish. Those which are sold are usually poor specimens. Despite the high mortality rate, thousands of orchid plants have been shipped out of the country. Such being the fact, one cannot help but wonder whether orchids like *Arachnis lowii*, *Dendrobium farmeri*, *Habenaria carnea*, *Paphiopedilum niveum*, *Phalaenopsis denevei*, *Rhynchostylis retusa* and *Vanda dearei* will one day become extinct in the areas where they occur.

Although there are forest reserves, the authorities of such reserves are apparently more concerned with the conservation of timber trees than with smaller herbaceous plants. As a result it is a common practice for orchid collectors to go collecting in these reserves. The public seems to have more respect for nature reserves than for forest reserves. Therefore, one way of protecting orchid species is to have nature reserves where such species occur, especially those which are fast becoming scarce. Cooperation among forestry departments, botanic gardens, nature societies and relevant authorities could help to map out areas which should be declared as nature reserves. In this project the botanic gardens would be the competent authorities in pointing out areas where orchids occur.

The control on export of orchid plants from a country would help toward conservation and in this respect there should be close cooperation between the agricultural and customs departments of a country and the botanic gardens. Orchids which are threatened with extinction should be totally banned from export, and proper control on others to be exported should be enforced. The customs officer and the agricultural officer are not familiar with orchids and their identification, and the services of a competent authority such as the botanic gardens would have to be sought. Among the three departments, a scheme backed by proper legislation could be put up whereby the control of the export of orchids could be effectively carried out.

Members of the staff of the Singapore Botanic Gardens give a number of talks and demonstrations through horticultural societies and the opportunity is taken to emphasize the importance of conserva-

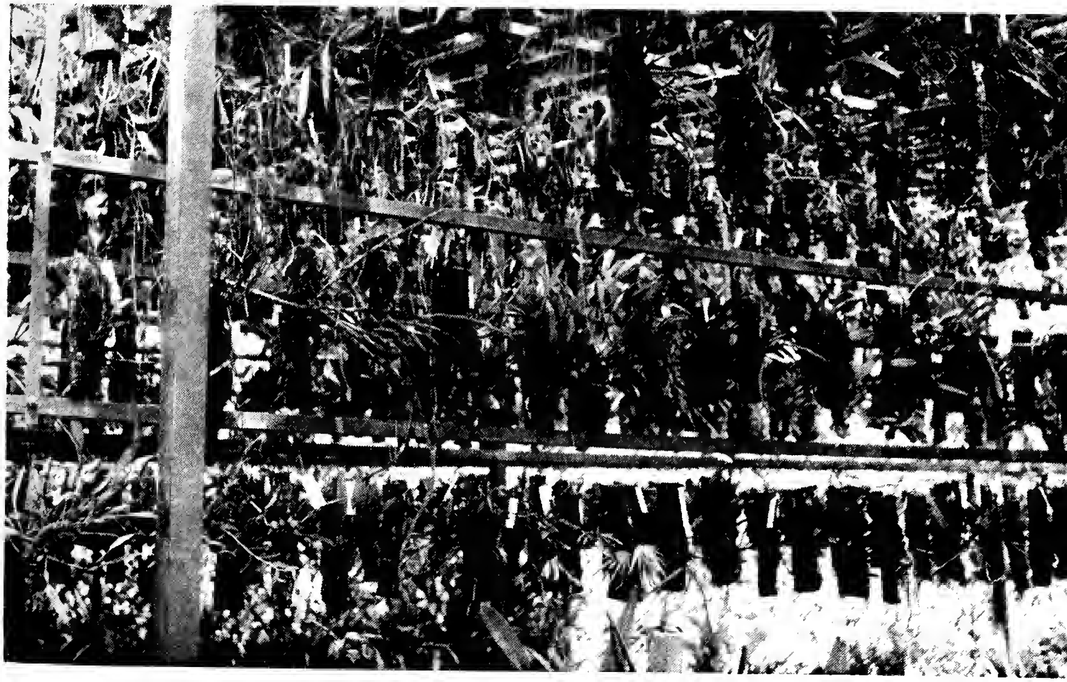
tion. Collectors of orchids are advised not to strip the areas where orchids naturally occur, but to collect only a few and to leave the bulk behind to multiply themselves.

The collection of orchid species, their propagation and consequent multiplication are probably the most practical steps of orchid conservation carried out by the Singapore Botanic Gardens. Every year numbers of orchid species are collected by experienced members of the Botanic Gardens staff from different parts of Malaysia. These are carefully grown and when they flower the flowers are "selfed." Orchid pods contain thousands of seeds; consequently, thousands of seedlings of a particular species can be produced by selfing. Such a species, if destroyed completely in its natural habitat, would be conserved in the Botanic Gardens by the thousands. Particular attention is paid to species which are on the verge of becoming extinct. Where there is a surplus of plants the species are exchanged with other botanic gardens, or even sold to members of the public in the hope that they in turn will propagate and multiply the species. Malaysia is rich in wild plants of various genera, but fortunately it is only the orchid which is being depleted in such large numbers that it is in danger of being destroyed. For this reason the work of the Singapore Botanic Gardens to date has been confined to conservation of orchids.

Phalaenopsis denevei, now believed to be extinct in Sarawak. It is still found in Indonesian Borneo.

In this article on conservation and the role of the botanic gardens I have outlined what one botanic garden is doing in this connection. I am sure that there are many other botanic gardens, particularly in the tropics, doing their share in conservation, be the plants orchids, ferns, gingers, bamboos, aroids or other endangered kinds. ◆

Epiphytic orchids growing on logs in the Singapore Botanic Gardens conservatory.



GROWING NATIVE ORCHIDS

A large proportion of the terrestrial species can be cultivated if given correct conditions and attentive care

Frederick W. Case, Jr.

GROWING the native terrestrial orchids of the northeastern United States and adjacent Canada* presents an unusual challenge to the gardener. For the most part few serious attempts have been made and the successes are fewer yet. There is a reason for this.

Most native orchids are plants of specialized soils and specialized habitats. Nearly all species live throughout their lives in association with soil fungi. The balance between the orchid plant and the fungus is a delicate one, easily destroyed, with the resultant destruction of the orchid partner. In wild orchids, fungi, usually of the genus *Rhizoctonia*, penetrate the root or rhizome structure of the orchid; branches of the fungus mycelium enter the living orchid cells. The special tissue formed of both plants is termed the *mycorrhiza*. The association of the two organisms is called *symbiotic*, the orchid contributing photosynthetically manufactured foods, the fungus contributing absorbed materials from the soil or its contents. Only in highly specialized environments such as very acid or very sterile soils (or those rendered absorptively sterile by unusual chemical concentrations) can the specialized orchid-fungus or mycorrhizal relationship be maintained. Hence, the limited occurrence of orchids within their natural range.

Author photos

The lady's-slipper or moccasin-flower, *Cypripedium calceolus* var. *parviflorum*.

To make matters even more difficult for the gardener, this special relationship between fungus and orchid starts at seed germination. As might be suspected, the seed germination process is critical. Orchid seeds at maturity lack the preformed embryo and food supply (endosperm) found in most seed plants. Instead, the nearly dust-like seed consists of a net-like cover surrounding a tiny mass of cells. Germination depends upon a supply of nutrient minerals and sugars. This is obtained when soil fungi attack the seed, digesting its outer cells. If the fungal growth is not too vigorous, those orchid seed cells not yet affected by the fungal digestion absorb some of the fungus's digestive products and utilize these for

*Half of the twenty orchid species treated here grow all the way to Florida; half a dozen more reach Georgia. Westward, sixteen range from eastern to central Canada and to at least the Middle West of the United States. Several go across Canada; one of these is found in Oregon. Seven extend southwestward into Texas. Despite the extent of their distribution in the wild, however, their cultivation offers such critical problems that it is to be encouraged only when the requirements can be met.—ED.

their growth. The first development of the orchid plant is a small mass of tissue, almost shapeless, called the *protocorm.* In our native terrestrial orchids the protocorm may become dependent upon the fungus which caused its germination, or with other soil fungi, and may remain in a dependent, saprophytic, underground state for months or even several years in the case of the lady's-slipper (*Cypripedium* species). Obviously, such a specialized life history presents complications too great for most gardeners to overcome under their garden conditions. Suffice it to say, almost no one has had success in growing our native terrestrial orchids from seed except under laboratory conditions.

If one is to grow the native terrestrial orchids, then, he must have a source of mature or nearly mature plants. Such a source is usually through purchase or collection. Although the number of kinds available is limited, orchid plants are obtainable from several American nurseries. Fortunately, most of them offer the more showy of our species.

Goodyera pubescens, known to wildflower enthusiasts as rattlesnake-plantain.

Habenaria psycodes, the purple fringed orchid.

Conservation Considerations

Collection of our native orchids from the wild is a controversial subject and should be approached thoughtfully. Most states have laws which restrict collection of native plants, especially orchids. Many avid conservationists become livid at the mere suggestion of taking orchids from the wild. However well-meaning these reactions are, and however well-intended the laws, both the thinking of the conservationist and the law need to be updated. Plants of such specialized growth as orchids need proper habitat in which to grow. No anti-picking laws can restore drained bogs, marshes or meadows. No orchids can grow on a lakeshore filled in to provide lawn for a cottage. Pasturing, urban development, or parking lots do not provide needed conditions for these rare plants. A responsible, concerned collector, occasionally taking a few plants for his garden, would not in years of collecting do the damage to an orchid population of one bulldozer filling a

marsh on one afternoon. Conservationists should be reasonable in light of our times. Of course I do not advocate wanton collecting, ever, nor irresponsible commercial collecting. No station for a rare species should be stripped of all its plants, for these plants produce seeds to start new colonies elsewhere. But since many orchid colonies become established only during certain stages of vegetational development and later begin to die out naturally as conditions change, a few plants can usually be removed without permanent damage to the species. Many of our showiest kinds, especially the cypripediums, form clumps. It is possible to remove shoots and offsets from such clumps without in any way injuring the main clump. One clump of yellow lady's-slippers (*Cypripedium calceolus*) in my garden has furnished gift plants for years, yet still has 27 flowering stems.

When considering orchid conservation problems, we should note that for years we have allowed hunting and fishing of certain animal species, some of which are quite rare. Wise use of this resource, especially when coupled with management of the species, has not destroyed them,

Liparis liliifolia, one of the false twayblades.

and has, in many instances, increased their numbers. What is needed badly in wild orchid conservation is not futile non-picking laws or an overly sentimental approach to their preservation, but rather establishment of natural areas of varied habitat within heavily developed regions to provide a natural environment for wild things. Since natural areas also undergo changes through plant succession and geological processes, mere establishment of preserves is *not* enough. The areas must be dedicated to production of given forms of plant and animal life, and then must be *managed* to maintain the desired environmental conditions. The benefit of this is that not only the orchids, but all the wildlife requiring the same basic conditions, will prosper. Unfortunately, it does not appear that the general public or even some plant conservationists are ready to accept this concept yet, although habitat management for game has been successful for years:

What about the native orchid colonies presently marked for destruction? I do not advocate ignoring the law, but it seems that some provision should be made to allow legal collection of plants doomed to perish. It is a fact that some states provide in their plant protection laws for possession of a few plants of each protected species. Perhaps in some areas, plant collectors could be licensed to reduce the danger of excessive collecting of rare species.

It is obvious that the gardener, before collecting in the wild, should apprise himself of the local laws and conditions. Assuming that one has a legal and proper source for live plants of our native orchids, how may such specialized plants be grown? Two basic methods present themselves: outdoor culture and greenhouse culture. Let us consider the two methods separately.

Garden Culture and Naturalization

If your land area is large, with semi-natural soils or natural, undeveloped areas, you may already have suitable conditions for some orchid species. Mixed deciduous woods or groves containing native

Habenaria blephariglottis, white fringed orchid.

ferns and shrubs may be fully suitable for certain lady's-slippers, showy orchis (*Orchis spectabilis*), purple fringed orchid (*Habenaria psycodes* varieties), downy rattlesnake-plantain (*Goodyera pubescens*) and others. Streambank habitat is also acceptable to many species provided the soil is not clayey. To make sure that you select the correct species, studying your own special conditions is important. You should consult a number of wildflower books and culture articles before proceeding. Soil analysis and tests for acidity prove helpful. Unfortunately, most persons will not have such natural conditions to work with, and will need to provide a special soil bed in the garden for native orchids.

In preparing the bed, keep in mind that many of our orchids grow in rather acid, sterile soils, also in bogs, sand dunes, or pine needle humus. For these excavate a bed at least 10 inches to one foot deep and as long and wide as desired. Before adding a prepared soil, some provision must be made to prevent earthworms from bringing up unsuitable soil from below. Do not use cement or other highly alkaline materials for this barrier. A sheet of plastic with drainage holes at intervals will work, as will a layer of perlite or granite gravel. Above this, fill with a mixture of quartz sand to which peat and spent tanbark or fir bark has been added. The proportions of the mixture depend somewhat upon the regional rainfall. The drier the area and the soil in summer, the more peat and bark can be added. I suggest, however, that such prepared soils be at least 65 per cent sand. If too organic, the soil may become excessively sour, causing bacterial or fungal destruction of the plants growing in it.

To provide drainage, the prepared soil bed should be built up above ground level about 5 or 6 inches. While many of our showiest native orchids grow in bogs, they grow in other situations as well. Water is rarely the essential reason for their presence in the bog. Under garden conditions, water must be watched carefully. The soil around plants should be continuously moist, but never soggy; otherwise rot may ensue.

Many species prefer cool soils, or those with little temperature fluctuation during

Spiranthes cernua, known as ladies'-tresses.

A NOTE ON FLORIDA ORCHIDS

"ENCOURAGE the public to respect the orchids, to watch them and enjoy them *in their native habitat*," writes Dr. Carlyle A. Luer, orchidologist and conservationist of Sarasota, Florida.

"Terrestrial orchids are exceedingly difficult to cultivate. They grow in a very delicate balance in only the right kind of soil in the right degree of acidity and moisture, and often in association with certain fungi. These plants are far too few in number to permit many people to try their hand at moving them into cultivation. It is essentially hopeless.

"Most of our epiphytic species are much hardier. Many people in southern Florida do grow them outdoors without too much attention. Our most common and most hardy species is *Epidendrum tampense*. It also happens to be quite pretty. However, if many amateurs in the North were to want one, we would soon have too few in Florida, where they belong.

"The public should be encouraged not to disturb them."

the growing season. Light shade from trees or shrubs may be utilized to provide some soil-temperature control. A mulch of fir bark, tanbark or pine needles is especially useful, for it helps not only to insulate the orchid's roots from temperature change, but also helps to keep down weed competition, a condition frequently fatal to orchids. Furthermore, such a mulch can help to maintain the acidity and moisture content of the soil.

Greenhouse Culture

If you have the facilities of a small greenhouse, and have the interest and patience, most of the terrestrials suited to garden culture can also be grown in the greenhouse. Most lady's-slippers and many other kinds can be grown as pot plants in either their native soil or a prepared one. Be sure, however, to note the comments below on containers for indoor planting.

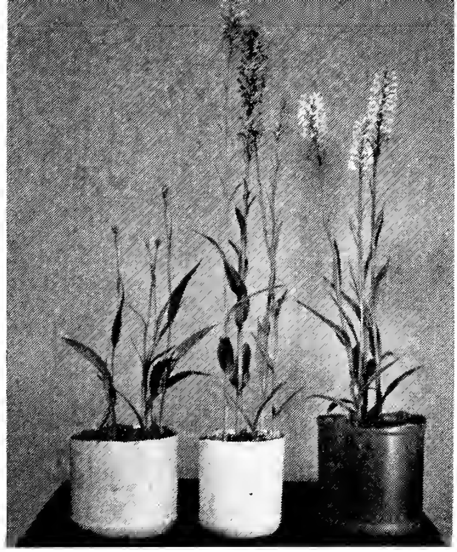
Bog orchids and those species requiring rather intensely acid soils can be grown well in live sphagnum. This method has proved surprisingly easy provided you avoid certain problems. Regular unglazed clay flowerpots are unsatisfactory for most terrestrial orchids or other bog plants. They seem to be chemically unsuited, and bog plants grown in them quickly sicken and die. Wooden tubs are satisfactory for a period until decay of the pot develops, then they too become unsuitable, the sphagnum moss dies and soon the orchid follows.

Glazed ceramic and plastic pots are good. Plastic paint pails, just as good, and generally available at less cost in larger sizes, may be obtained at paint or variety stores. I have seen several persons use cut-off plastic bleach jugs with excellent results (*see* illustration, page 71). These plastics are chemically inert; at least they do not inhibit the growth of sphagnum moss. Small drainage holes should be punched in the plastic containers.

The potting medium should be clean,

Isotria verticillata, whorled pogonia.

Live sphagnum (here with *Sarracenia*), using a tray method of culture, in which the water rises from below.



Habenaria ciliaris and *H. blephariglottis* growing in sphagnum in plastic containers.

weed-free, living sphagnum moss. I have used several species, but the most satisfactory types are those larger-headed species found in damp acid sand or near bog borders, not those from far out in open bogs. Masses of the sphagnum should be arranged with the growing ends uppermost; an attempt should also be made to place the moss to form an even surface. No special drainage material such as potsherds need be placed in the container below the live moss. After arrangement of the moss in the pot, the roots or tubers of the orchid should be inserted just under the upper surface.

Living sphagnum must be kept moist at all times. This may be accomplished by frequent watering, or by standing the pots in a tray of shallow water, allowing capillarity to distribute the moisture (*see* illustration above).

Chlorinated water used repeatedly, Malathion-type sprays of strong dosages, and water containing metallic salts all damage or destroy sphagnums and, subsequently, the orchids growing in them. To avoid problems, use rain water or distilled or de-ionized water. If a plastic tray is not available in which to stand pots, metal or wooden trays may be lined with polyethylene plastic sheeting to insulate the moss, orchids and water from sources of metallic salts. Never fertilize living sphagnum. Death usually results. If you do utilize the tray method of growing the moss and orchids, the moss should be watered heavily from above at least once a week to dissolve away mineral salts deposited on the moss surfaces by evaporation. When treating insect pests, avoid contact of the insecticide with the moss.

Proper soil temperature during the dormant season is just as important as during the growing season. Most of our native orchids require a definite rest at low temperatures before they will commence new growth. Provision must be made to keep greenhouse-grown plants close to freezing temperatures during at least part of the winter dormant period in order to initiate new growth. I hold my plants at 38 degrees Fahrenheit during the winter season. The plants should not actually freeze.

Depending upon the climate of the region, the methods suggested for greenhouse culture may also be adapted to a coldframe, heated or unheated.

Pests and Problems

The usual garden and greenhouse pests prove serious hazards to terrestrial orchids, for their foliage is often soft and

succulent. Many species exude a vanilla-like odor which seems to attract slugs and snails. One large slug can wreak havoc overnight. Control of slugs and snails may be had by use of any of the commercial slug-snail baits or sprays. It is not known what effect continued use of these sprays will have on the soil in pots if used as a drench; therefore I recommend the pellet form of the bait used only as necessary.

Aphids, perhaps the worst enemy of many of our terrestrial orchids in the greenhouse, must be watched carefully. Even the dormant growth bud nestled in the moss or at the soil surface may be attacked. The result of aphid attack is deformity or complete destruction of the plant. Any regular aphid spray seems to be satisfactory, but one should always use caution and experiment with a few plants before undertaking blanket application.

Thin-leaved species are subject to red-spider attack. Most of the damage occurs before the presence of the pest has been detected. Malathion is suitable for control, but contact with sphagnum *must* be avoided. The same control may be used for the various scale insects.

Small animals—especially squirrels, chipmunks, meadow-voles and white-footed mice—should be controlled, for they can be very destructive, eating tubers, dormant growth buds, and also flower buds.

Leaf-chafer beetles often eat flower buds of the fringed orchids, and may, in fact, eat out the heart of the stem's growing tip while it is enfurled in the leaves. Dusting with DDT or rotenone, especially during early development of the stem, provides good control.

Fungus-caused leaf spot or rot proves difficult to control once it occurs on terrestrials. General garden fungicides or those used to control leaf-spot on roses will aid. If a leaf is badly infected, it should be removed by cutting well back into healthy tissue with a sharp, clean razor blade.

Challenge and Service

Many native terrestrial orchids can be grown, at least by skillful gardeners. It will take determination, careful attention to the needs of the plants, and some experience. The successful grower not only enjoys the beauty and challenge of these rare plants, he may contribute to the conservation of the species, either by maintaining plants that would otherwise have perished, or by providing divisions of the original plants to other interested persons. When the day comes that ecologists and other specialists can grow our natives readily from seed, cultivated plants can be used to provide the parent stock. ◆

DISCRETION AND RESTRAINT

(Continued from page 48)

have burst open to fill the greenhouse with their tangy odor and to amaze all comers with their weird shapes, or if you can let a neighbor child push his finger against the trigger of a catasetum and watch his astonishment as the pollinia shoot out. It can only add more beauty to benches filled with homogeneous plants to have a few brown and yellow butterflies of *Oncidium papilio* soaring overhead, or a feathery spray of one of the many-flowered oncidiums. You can read about masdevallias and look at pictures of them, but you will never believe them until you grow some.

One of the greatest thrills of all is to go orchid collecting—to gather species in native haunts. Restraint is difficult to practice. But as your collecting bags become stuffed, do give a thought to what you are going to do with all those plants. However, if you come across an area that is being cut over for farming or lumbering operations, then you may happily assume the role of savior of orchids otherwise doomed to destruction and gather all you can find. ◆

SOME ORCHID PESTS AND THEIR CONTROL

G. W. Dekle

DO insects find your orchid plants palatable? Do they seem to find a home on your plants—as some visiting relatives seem to thrive on kinfolk hospitality? If so, you are my audience.

It is common among orchid growers to inspect their plants frequently. This is basically a sound practice. Look carefully at flower, leaf, pseudobulb, and roots. The potting media and container must also be given the "once over" view. If a pest is encountered during an inspection, it is important to be able to recognize the critter, and equally important to know the type of mouthparts used for feeding. Once the pest is identified, it is possible to select from the control chart at the end of this article one of the recommended materials.

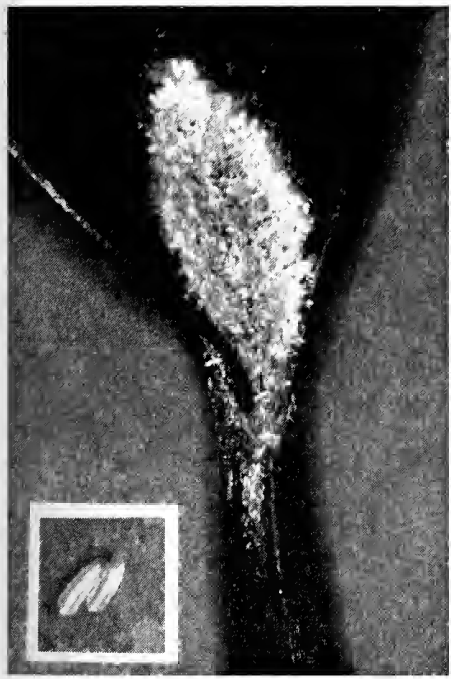


Fig. 1. Mass of male Boisduval scale. (Inset X13)

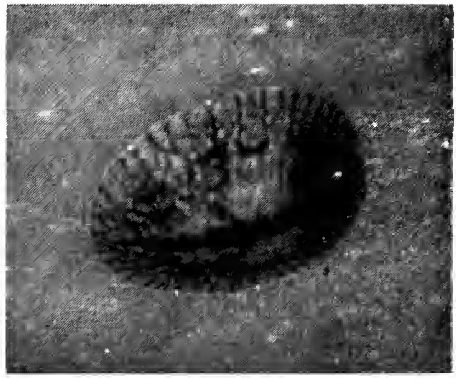


Fig. 2. Brown soft scale female. (X13)

Principal Pests

Armored Scale Insects. Armored scales (29 have been reported in Florida) are small insects which usually are found on the leaf or pseudobulb. They attach themselves to the plant by hairlike mouthparts. The insect is concealed beneath a protective cover which is commonly referred to as the armor. The armor is non-living and composed of secreted material incorpo-

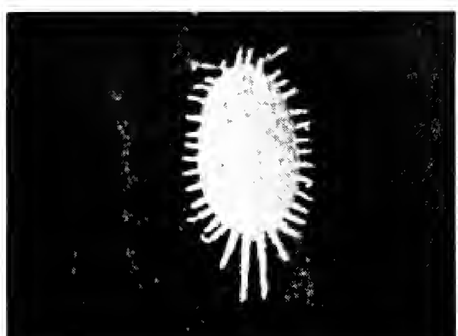


Fig. 3. Orchid mealybug. (X10)

Fig. 4. Green peach aphids. (X12)

rated with discarded nymphal cast skins. It is firmly cemented to the host and is apparently water-tight.

Boisduval scale (Fig. 1) is the number one pest of orchids in Florida. The males usually occur in such numbers as to give the appearance of a cottony mass on the leaf. Severe infestations cause yellowed or darkened areas to develop on the host.

Soft Scales. Though also feeding with a hairlike mouthpart, a detachable protective armor is lacking in soft scale insects. Only one of the seven species recorded in Florida (brown soft scale, Fig. 2) is considered to be of economic importance. Parasitized specimens are extremely convex and dark brown.

Mealybugs. Mealybugs are soft-bodied insects with piercing-sucking mouthparts. They are capable of moving freely about the plant to feed. Sooty mold, a fungus, is often found associated with these insects, also with soft scales and aphids. It develops on the honeydew excreted by the insects. Orchid mealybug (Fig. 3) is oval in shape and coated with a powdery white wax secretion. The filaments are distinct around the body margin. Mealybugs are most often found under growth sheaths or in a tender developing growth.

Mites. Mites are minute arthropods with four pairs of legs. The spider mites and false spider mites are plant feeders and are responsible for injury to the leaf, stem and pseudobulb, apparent as a silvery stippling.

Aphids. Aphids or plant lice are small soft-bodied insects about 1.5 to 2 mm in length (Fig. 4). They may be greenish, yellowish, brownish, or black and have piercing sucking mouthparts. Aphids may be found on the developing leaf, bloom spike or flower and will cause deformity, or when numerous on a bloom spike, dropping of buds.

Springtails. Springtails are minute grayish or white jumping insects with chewing or piercing mouthparts. They are usually found in the potting media or on the roots.

Thrips. Thrips are very small in size, about 0.05 to 1.0 mm in length. They have rasping sucking mouthparts. Flower thrips move rapidly and appear sometimes to jump.

Beetles and Weevils. Some of the

Fig. 5. Slug and slug injury to flower. (X13). Arrow points to injury.

SPRAY CHART FOR ORCHID INSECTS

L. C. Kuitert[1] G. W. Dekle[2] J. E. Brogdon[3]

INSECT	INSECTICIDE AND FORMULATION	DOSAGE 1 Gal	100 Gal
ARMORED SCALES, SOFT SCALES & MEALYBUGS	*Dimethoate (Cygon) 23.4% EC	2 tsp	2 pt
	**Ethion 23–25% EC	2 tsp	2 pt
	plus Oil Emulsion 97%	3 Tbs	3 qt
	Malathion 25% WP	6 Tbs	6 lb
	Malathion 50–57% EC	1 Tbs	3 pt
	Meta-Systox-R 25.4% EC	2 tsp	2 pt
MITES	Aramite 15% WP	1½ Tbs	1½ lb
	Chlorobenzilate 25% WP	1 Tbs	1 lb
	Dimite	1 tsp	1 pt
	Ethion 23–25% EC	2 tsp	2 pt
	Kelthane EC 18½%	1 tsp	1 pt
	Kelthane WP 18½%	1 Tbs	1 lb
	Meta-Systox-R 25.4% EC	2 tsp	2 pt
APHIDS	*Dimethoate (Cygon) 23.4% EC	2 tsp	2 pt
	Lindane 20% EC	1 tsp	1 pt
	Lindane 25% WP	1 Tbs	1 lb
	Malathion 25% WP	4 Tbs	4 lb
	Malathion 50–57% EC	2 tsp	2 pt
	Meta-Systox-R 25.4% EC	1 tsp	1 pt
SPRINGTAILS & THRIPS	DDT 50% WP	2 Tbs	2 lb
	*Dimethoate (Cygon) 23.4% EC	2 tsp	2 pt
	Lindane 25% WP	1½ Tbs	1½ lb
	Malathion 25% WP	4 Tbs	4 lb
	Malathion 50–57% EC	2 tsp	2 pt
CATERPILLARS, BEETLES & WEEVILS	DDT 50% WP	2 Tbs	2 lb
	Lindane 25% WP	1½ Tbs	1½ lb
ANTS & COCKROACHES	Chlordane 40% WP	2½ Tbs	2½ lb
	Chlordane 42–46% (Spray benches, interior and exterior walls)	2 tsp	2 pt
SNAILS & SLUGS	Metaldehyde 15% D (Dust in and around pots and benches)		
	Metaldehyde WP or Baits (Follow label directions)		

Abbreviations: Tbs = tablespoons, tsp = teaspoons, pt = pint, lb = pound, EC = emulsifiable concentrate, WP = wettable powder and D = dust.

*DIMETHOATE (CYGON): This material is reported to cause injury to the following orchid plants: *Calanthe* sp., *Cycnoches ventricosum* Bateman (= *C. ventricosum* Bateman var. *warscewiczii* (Reichb. f.) P. H. Allen) which is erroneously advertised in orchid trade lists in the United States as *Cycnoches chlorochilon* Klotzsch., *Dendrobium moschatum* Lindl., *D. pulchellum* Roxburgh (= *D. dalhousieanum* Wall.), *D. phalaenopsis* (type) and *Neomoorea irrorata* Rolfe.

**ETHION + OIL: Not recommended for community pots. Ethion is available with oil in prepared formulations; follow label directions for scale control.

[1] Entomologist, Florida Agricultural Experiment Station
[2] Entomologist, Division of Plant Industry
[3] Entomologist, Florida Agricultural Extension Service

most destructive pests known to man are found in this group, but happily, only one species is of serious consequence to orchid growers in Florida. A scolytid beetle, which is small and black, bores into the canes of *Dendrobium* species and also attacks the psudobulb of *Cattleya* species. The presence of the insect is known when small shot-holes are observed on the plant.

Ants and Cockroaches. Familiar pests to the non-orchidists, it is enough to say that ants are usually present wherever orchids are grown. Don't forget that cockroaches are nocturnal in habit and can be damaging to orchids.

Slugs and Snails. Slugs and snails (Figs. 5 & 6) are not insects. They are mollusks, like oysters and clams. They usually forage at night and snip or clip their food with sharp mandibles. During the day they may be found concealed beneath rocks, boards, containers, or other dark hiding places, or in the case of the tiny dark bush snail, highly destructive

Fig. 6. Snail resting on phalaenopsis flower. (X12)

to orchid roots, in the interstices of potting media. Slugs lack a protective shell and this distinguishes them from snails. Humid conditions which are favorable for growing orchids are also perfect "set-ups" for them. This group of mollusks plagues all orchid growers by feeding on plants; the flowers are apparently a delicacy. Their presence is indicated by a slime trail. ♦

ORCHID DISEASES

THE subject of orchid diseases is complicated for the layman by similarity of symptoms, and while of real importance to growers, cannot be dealt with in such a way as to be of value within the space limitations of this Handbook. It is for this reason that we have decided to refer readers to the fine 57-page booklet by Harry C. Burnett (Plant Pathologist with the Florida Department of Agriculture) entitled *Orchid Diseases.* It is directed to the hobby grower, and is extensively illustrated with diagnostic color and black-and-white photographs. It is obtainable for $.50 from the State of Florida, Department of Agriculture, Division of Plant Industry, P. O. Box 1269, Gainesville, Florida 32601.

Virus

One class of diseases, however, deserves brief mention. Virus diseases of orchids have, with recent surge of hobby collections, become increasingly important since they are spread largely through the carelessness of the growers themselves. There is no known cure for virus infections in orchids, thus careful preventive steps will reward the grower. It is important to sterilize all cutting instruments so they cannot transmit viral material from one plant to another. A 2% sodium hydroxide —2% formaldehyde solution has been found very effective, according to Dr. Burnett. When repotting, avoid carrying viral material from broken roots from one plant to the next by either using disposable plastic surgical gloves or washing your hands. Use a stack of open newspaper on your potting table, removing a sheet after each plant is finished.

Virus infections do not kill a plant *per se,* but they tend to weaken it and often cause the leaves and, in some cases, the flowers, to be unsightly from irregular sunken necrotic areas, streaking and discoloration. At times a plant will not have visible symptoms, hence it is important to treat *all* plants as if infected. ♦

SOURCES OF ORCHID NECESSITIES—PLANTS AND POTTING SUPPLIES

THE number of orchid "ranges" has reached the proportion, particularly in the semi-tropical areas of the United States, where a complete list is impossible. The *American Orchid Society Bulletin* contains full advertising which an interested buyer should investigate. As with all businesses, standards vary and it is wise to remember—*caveat emptor.* Listed here are those in the New York area and some very large, well known American companies. Almost all carry a full line of supplies as well as plants, and nearly all have lists or catalogues on request.

Alberts & Merkel Bros., Inc., P. O. Box 537, Boynton Beach, Florida 33435
Nearly all types; emphasis on "art shade" cattleyas.

Ashcroft Orchids, 19062 Ballinger Way N.E., Seattle, Washington 98155
General wide selection with many cool growers available.

Casa Luna Orchids, Star Route 1, Box 219 A. Beaufort, South Carolina 29902
Specialist in species and selected hybrids for the connoisseur.

Hausermann's Orchids, Inc., P.O. Box 363, Elmhurst, Illinois 60128
Full line of species and standard hybrids. Informative catalog.

Margaret Ilgenfritz Orchids, Monroe, Michigan 48161
One of the best sources for botanicals listing miniature orchids among a wide selection of imported species.

J & L Orchids, Chestnut Hill Road, R.D. 2, Pottstown, Pennsylvania 19464
Wide selection of species and miniatures —specialists in phalaenopsis.

Jones & Scully, Inc., 2200 N.W. 33rd Avenue, Miami, Florida 33142
High quality and broad selection—they mail a well-illustrated catalogue.

Kensington Orchids, Inc., 3301 Plyers Mill Road, Kensington, Maryland 20795
Good commercial collection and many meristems of fine clones.

Wm. Kirch—Orchids, Ltd., 732 Kapahula Avenue, Honolulu, Hawaii 96816
Wide range of hybrids particularly in "botanical" crosses as well as the more traditional breeding lines.

Oscar Kirsch, Inc., 2869 Oahu Avenue, Honolulu, Hawaii 96822
Quality species and hybrids, particularly of dendrobiums and phalaenopsis.

Lager & Hurrell, 426 Morris Avenue, Summit, New Jersey 07901
Founded in 1896 and well-named "The House of Unusuals"—general supplies as well.

Marmon Florist, 197-23 47th Avenue, Flushing, New York 11358
Dependable hybrids on which a beginner can cut his teeth.

Rod McLellan Co., 1450 El Camino Real, South San Francisco, California 94080
Full selection, from fine paphiopedilums and yellow cattleyas to species.

H. Patterson & Son, Orchidhaven, 332 East Main Street, Bergenfield, New Jersey 07621
Specialist in commercial genera, particularly cattleyas.

Penn Valley Orchids, 239 Gulph Road, Wynnewood, Pennsylvania 19096
A hobbyist business: many fine, awarded plants, particularly paphiopedilums and rare species.

Rivermont Orchids, Signal Mountain, Tennessee 37377
Developer of many award cattleyas through extensive breeding work.

Shaffer's Tropical Gardens, Inc., 1220-41st Avenue, Santa Cruz, California 95060
Again a large selection, this time the specialty being phalaenopsis.

Snyder Bros. Orchids, 120 Parkside Road, Plainfield, New Jersey 07060
Chiefly cattleyas and cymbidiums.

South Shore Floral Co., 1050 Quentin Place, Woodmere, L. I., New York 11598
Strictly supplies; small quantities available in a wide selection for hobby growers.

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BOOKS FOR THE ORCHID GROWER

Basic Culture

Mary Noble: *You Can Grow Orchids.* Author publisher, 3003 Riverside Avenue, Jacksonville, Florida 32205. Third edition, 1964. $2.50.

Rebecca Northen: *Home Orchid Growing.* Van Nostrand, New York. Second revised edition, 1961. $10.95.

Rebecca Northen: *Orchids as House Plants.* Van Nostrand, New York, 1965. $4.95.

John W. Blowers: *Pictorial Orchid Growing.* Author publisher, 96 Marion Crescent, Maidstone, Kent, England. 1966. $5.00.

Your First Orchids and How to Grow Them. Revised edition, 1967. Oregon Orchid Society, Inc. P. O. Box 2184, Portland, Oregon 97214. $2.50.

Jack Kramer: *Growing Orchids at Your Windows.* Van Nostrand, New York, 1963. $4.95.

T. A. Fennell: *Orchids for Home and Garden.* Rinehart, New York. Revised edition, 1959. $3.95.

Alex D. Hawkes: *Orchids, Their Botany and Culture.* Harper, New York, 1961. $7.95.

Jeanne Garrard: *Growing Orchids for Pleasure.* A. S. Barnes, New York, 1966. $7.50.

Walter Richter: *The Orchid World.* E. P. Dutton, New York, 1965. $12.50.

Reference Books

Sanders' Orchid Guide. Revised edition, 1927, reprinted by American Orchid Society. $10.00.

Harry C. Burnett: *Orchid Diseases.* State of Florida Department of Agriculture, Gainesville. 1965. $.50.

B. S. Williams and Henry Williams: *The Orchid Grower's Manual.* Seventh edition, 1894, reprinted by Stechert-Hafner, New York. $28.00.

James Veitch: *A Manual of Orchidaceous Plants.* Two-volume reprint by Stechert-Hafner, 1963. $60.00.

Alex D. Hawkes: *Encyclopaedia of Cultivated Orchids.* Faber & Faber, London, 1965. $37.50.

Carl Withner, editor: *The Orchids: A Scientific Survey.* Ronald Press, New York, 1959. $14.00.

Proceedings of World Orchid Conferences. Royal Horticultural Society. Third, 1961. $6.00. Fifth, 1966. $8.95.

R. E. Schultes and A. S. Pease: *Generic Names of Orchids, Their Origin and Meaning.* Academic Press, New York, 1963. $12.00.

Register of Awards. American Orchid Society. Supplement IV, 1964. $5.00; Supplement V, 1966. $6.00.

Handbook on Judging and Exhibiting. American Orchid Society. Third edition, 1961. $1.00.

Sander's Complete List of Orchid Hybrids. 1946 edition. $25.00.

E. A. C. L. E. Schelpe: *An Introduction to South African Orchids.* McDonald & Co., Ltd., London, England, 1966, $26.75.

G. C. K. Dunsterville: *Introduction to the World of Orchids.* Doubleday, New York, 1964. $11.75.

Floras

G. C. K. Dunsterville and Leslie A. Garay. *Venezulean Orchids Illustrated.* Vol. 1, 1959; Vol. II, 1961; Vol. III, 1965, Vol. IV, 1966; Vol. V in preparation. $20.00 each. Andre Deutsch, Ltd., 105 Great Russell Street, London, W.C. 1, England. Museum Books, 48 E. 43rd St., New York.

Donovan S. Correll: *Native Orchids of North America.* Chronica Botanica Co., Waltham, Massachusetts, 1950. $8.50.

Frederick Case: *Orchids of the Western Great Lakes Region.* Bulletin 48, Cranbrook Institute of Science, Bloomfield Hills Michigan, 1964. $7.00.

WHAT IS AN ORCHID?

(*Continued from page* 10)

among the intellectual challenges constantly presented by these plants. No other family involves so many aspects of horticultural activity, from laboratory to greenhouse or garden. No other family can present some 30,000 species and some 75,000 hybrids for the grower to choose from. To anyone who becomes attached to them, orchids soon become much more than botanical curiosities—they are likely to become a way of life. ◆

All of these books except the Veitch and Hawkes volumes in the reference list are available from The American Orchid Society, Inc., Botanical Museum of Harvard University, Cambridge, Massachusetts 02138.

GLOSSARY

THE glossary presented here is in no sense comprehensive. It contains essentially those terms which the reader of the foregoing articles might find difficult or confusing. Botanical terms should not be frightening; they are exact, and once a grower becomes accustomed to them, they are invaluable in discussions of one's orchids.

Award initials. The FCC/AOS, AM/RHS, etc., which may follow an orchid's name. See "What's In a Name" (page 11) for explanation.

Back bulb. One of the older *pseudobulbs* on an orchid plant, suitable for use in propagation.

"Botanical". Orchid-growers' slang for all small or non-showy kinds of orchids, in contrast to the commercial corsage types of orchids. For the most part, these are grown and hybridized by hobbyists. (A better term is needed.)

Callus. An area at the base of the lip of the orchid flower that apparently is attractive to insects. Among orchid specialists it provides a diagnostic character for differentiating species.

Clone. All the plants derived by successive vegetative propagation, beginning with one original plant. In writing, the clonal name is set off in single quotation marks.

Column. The unique reproductive structure found only in the orchid family. The *stamens* are generally reduced to one or two (occasionally three are present) and are fused with the *style* and *stigma* of the *pistil*.

Community pot. In commercial catalogs often referred to as a "compot." The single pot or other container in which orchid seedlings are planted in groups of 15 to 20 after removal from the sterile culture bottle in which they were first sown.

Corm. A solid, bulblike, fleshy base of a stem, common to many terrestrial orchid species.

Crock. Another word for potsherds—pieces of broken flower pots which are placed in the bottom of a pot for drainage.

Cultivar. A race of plants, originated and maintained in cultivation for unusual or desirable qualities and given a special name. Distinct from a species.

Deciduous. Literally, *falling off;* used of plants which drop their leaves seasonally.

Epiphyte. Literally, *on a plant;* one plant which grows upon another, but *not as a parasite.* An epiphyte merely perches on the trunk or branches of its dwelling place —usually a tree.

Grex. All the sibling plants produced by hybridizing two species, a species and a hybrid, or two different hybrids.

Hapuu. Hawaiian tree fern (*Cibotium glaucum* or *C. chamissoi*). The aerial roots, which surround the trunk in a thick, matted layer, are used as a potting medium for orchids.

Keiki. Hawaiian word meaning a child or little one, used as a name for the offshoots or plantlets that develop from the main stem or on old flower spikes of certain orchid species. After their roots have developed they may be separated from the mother plant and grown as new individuals.

Labellum. The lip of an orchid flower, formed by one of the three petals.

Lead. A new growth arising on a sympodial orchid.

Mericlone. A plant produced by "meristemming."

Meristem. As a noun, *meristem* refers to embryonic tissue, the cells of which are capable of active division. As a verb, it is orchid-growers' slang for the method of propagation by which the apical cells are removed from the tip of an orchid shoot and grown on, by continued division, as individual plants. A plant produced by this method is called a *mericlone.*

Monopodial. One of the two types of growth habits in plants. (Compare *sympodial.*) *Mono,* meaning *one,* gives a clue to the meaning of the word. Monopodial orchids have only one stem, which grows continuously from the apex, on and on. As the stem elongates and produces leaves and flowers, roots come not only from the base, but usually also from the stem itself.

Osmunda. Roots of ferns of the genus *Osmunda,* used as a potting medium.

Ovary. The part of the *pistil* that bears the bodies (ovules) which can become seeds when fertilized. In an orchid flower the ovary is situated *beneath* the sepals and petals.

Pistil. The female reproductive structure of flower, consisting of *stigma, style* and *ovary.* In an orchid flower, stigma and style are fused with the *stamens* into a *column.*

Pollen. The male reproductive cells in a flower; in an orchid flower, borne on the *column* in a coherent mass called a *pollinium* (plural: *pollinia*).

Protocorm. The stage of growth of an orchid seedling before any leaves or roots have become differentiated. The minute embryo in the seed will have developed only into a little ball of cells.

Pseudobulb. A solid, bulbous enlargement of the lower part of the secondary stems, common among *epiphytic* orchids.

Rhizome. In general botanical parlance, a horizontal primary stem, either underground or at the soil surface. In *epiphytic orchids,* which grow on tree branches and other non-granular surfaces, there is no surrounding soil. In *sympodial* orchids, the rhizome connects successive growths, the distance between which varies in different species from a fraction of an inch to two feet.

Selfing. Pollinating a flower with its own pollen. While self-pollinating is usually avoided in the orchid family, it is sometimes desirable in cultivation to increase the number of plants in a given strain or to maintain a certain group of genetic traits.

Semi-alba. A descriptive word of commercial coinage used to designate a cattleya hybrid with white sepals, two white petals and a colored lip.

Stamen. Male reproductive organ in a flower, bearing at its tip the fertilizing cells called *pollen.* In an orchid flower, incorporated into the *column.*

Stigmatic surface. That part of the *column* of an orchid flower which receives the pollen. It corresponds to the *stigma* of flowers in other families.

Style. The stalk of the *pistil* which connects the *stigma,* at the tip, with the *ovary,* at the base. In an orchid flower, the *style* is incorporated into the *column.*

Sympodial. One of the two types of growth habits in plants. (Compare *monopodial.*) In sympodial growth, the apex of a stem does not continue growth; instead, growth is resumed by a bud below the apex (in an orchid, generally on the rhizome) which repeats the process. As a sympodial orchid puts out new growth periodically at its base, it "walks" along year after year, growth after growth.

Tepals. Sepals and petals of a flower when they are similar in form and color.

Terete leaves. Fleshy, cylindrical leaves which taper to a point. They can vary from the size of slender knitting needles to that of big cigars.

Velamen. The white, thick, spongy, absorbing and anchoring layer of cells that covers all but the growing tip of the aerial roots of orchids.

Xerophytic. Adapted to a dry environment, succulent, wax-covered leaves and fleshy stems being the usual modifications. Most epiphytic orchids show one or more such adaptations, as do cacti and other succulent plants.

THE AMERICAN ORCHID SOCIETY

MORE than 11,000 orchidists, from rank beginners to accomplished experts, are members of The American Orchid Society. The most direct advantage they receive is the monthly *Bulletin,* averaging 96 pages, which provides information for both amateur and expert. The indirect benefits are many: assistance for 200 local affiliated societies; a Fund for Education and Research; orchid judging at shows run on a national basis; a conservation committee that works to protect orchids in their natural habitats, and so on.

Readers who might like to attend an orchid meeting should write to The American Orchid Society, Inc., Botanical Museum of Harvard University, Cambridge, Massachusetts 02138, for the address of the nearest local group. Anyone already serious about growing orchids may send ten dollars to the same address for membership.—S.S.J.

OTHER ATTRACTIVE GIFTS

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BROOKLYN BOTANIC GARDEN RECORD

PLANTS & GARDENS

ORIGINS OF AMERICAN HORTICULTURE

The Beginnings of the Nursery Trade

Plants Acquired Through Exploration and Importation

Plantsmen Who Have Influenced Gardens

Introductory Dates of Plants Most Used in Landscaping

AUTUMN
1967

NEW SERIES
VOL. 23 No. 3

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PLANTS & GARDENS

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Origins of American Horticulture

CONTENTS

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Copies of this and other issues of PLANTS & GARDENS are available as Handbooks. For a list of topics see back cover.

Brooklyn Botanic Garden

Yellow-wood (*Cladrastis lutea*). This fine specimen was presented to the Botanic Garden by Henry Hicks in 1916. Though native to North Carolina, Kentucky and Tennessee, it is hardy across the northern states. Long clusters of fragrant white wisteria-like flowers appear in early summer. The tree was first named *Virgilia lutea* by André Michaux. This native American species was brought into cultivation in 1812. (See also page 21.)

BROOKLYN BOTANIC GARDEN

ABOUT THE ORIGINS OF AMERICAN HORTICULTURE

This Handbook presents the story of the diverse origins of ornamental horticulture in America—plant exploration, the first seed firms, nurseries and botanic gardens, and the people who brought them into being—and when. But no great development such as this ever has its roots in one nation alone; it crosses national boundaries. Thus plant exploration in faraway countries has long contributed to the American scene—and American plants simultaneously have found their way to other lands.

In the early colonial days there was little time for growing ornamental plants beyond the dooryard garden. People, most of whom lived on farms, spent just about every waking hour raising crops for food, but as towns grew in size and wealth so did the opportunities to devote more time to esthetic interests.

Visitors from England and the continent botanized in Virginia and elsewhere, and a charming film, "The Colonial Naturalist" (produced by Colonial Williamsburg, Inc.), dramatizes the visit of Mark Catesby to Williamsburg during the years 1712 to 1719.

There were numerous other pioneer naturalists from Europe who explored for new plants in the colonies. Mountain-laurel, the southern magnolia, flowering dogwood and other magnificent American plants were discovered for the first time by civilized man and sent back, chiefly to the gardens of England.

Among the early Americans to become seriously interested in ornamental plants was a Pennsylvania farmer, nurseryman and plant explorer named John Bartram (see pages 17 and 77). Although his plant collection was, in a sense, the first of botanic-garden stature in America, it was—perhaps more importantly—the first more or less serious nursery enterprise. Bartram (and after him, his son) was beyond question the first American nurseryman.

It was John Bartram who made the historic discovery of the Franklin tree (just over 200 years ago) on a then remote river in southern Georgia (see page 35). It was relocated by his son and later by two other plant explorers, but after 1803 was never again seen as a wild plant.

It was nearly three years ago that this Handbook had its beginnings, and it is a pleasure to acknowledge the work of Guest Editor Dorothy Manks and the several authorities she invited to write with her—to bring the many historical accounts together. It is likewise a privilege to acknowledge the intense research interest of Frederick McGourty, Jr., of the Botanic Garden staff. It was his unflagging devotion to the horticultural origins recorded in these pages that finally helped to round out the subject matter to the point where the Handbook could go to press. One of his most exciting discoveries was a manuscript copy of an 18th-century Bartram catalog (see page 79).

All of us on the Editorial Committee here at the Garden are enthusiastic about the "Origins of American Horticulture." We hope the Handbook will give life to America's horticultural foundation-stones of nearly three centuries.

George S. Avery

Director

HOW THE AMERICAN NURSERY TRADE BEGAN

Dorothy S. Manks

COMMERCIAL horticulture was a business little known in this country before the 19th century. Nevertheless its roots go back to the early days of settlement. Its growth has been a vital part of the growth of the country, for farming, economics, social customs, territorial expansion, and motives of settlement all helped to direct its course.

When the Spaniards settled St. Augustine in 1565, they brought their familiar plants from Spain, and novelties from the subtropical West Indies. They may even have introduced the peach to North America, for, although it is a native of China, later settlers found it widely distributed, grown by the Indians, and even escaped from cultivation. Although the stay of the Spaniards was short, Florida still owes to them much of its present status as the center for the cultivation of subtropical plants.

Seeds for English Settlers

In the early 1600's the English came to establish permanent settlements. From the beginning, with seeds and slips brought from home, they planted their farms, so vital to their survival. There was no surplus from which to save seeds for the next year's planting, so they continued to rely on "home" sources for supplies. For some 200 years they imported their best stocks. The earliest weekly papers carried advertisements of seeds for sale at the general stores, though farmers sold fruit-trees (seedlings) from their own surpluses. "Horticulture" was represented only by fruit growing—apples, pears, and grapes, valued less for their edible qualities than as the makings of potent beverages. Every farmer put down many barrels of cider against the cold of winter, and used it both for comfort and for payment to the doctor, the teacher, and the parson. There are famous records of orchards of the 1630's and '40's, and even of a nursery of sorts in Connecticut between 1648 and 1653.

In the second half of the century came the Pennsylvania Dutch to Philadelphia, the Hollanders and the French Huguenots to New York. They were all skilled farmers, and in their new homes they planted vineyards, orchards, and market gardens which survived long after their brief political independence.

Farming in the South

In the southern colonies the plantation owners became the most important, if not the most numerous, class, raising cotton, indigo, rice, and tobacco with slave labor. Settlements were limited to the Coastal Plain and to river valleys, and Charleston was the only town which grew large enough to offer any market for farm produce. Two nurseries were opened there in colonial times, one by Henry Laurens about 1755 and one by John Watson in 1763. Both were well stocked with almost everything that grew in the southern climate. Both were put out of business by the Revolutionary War, but Watson's place was reopened later by Robert Squibb. Under the new ownership it made important contributions in collecting and distributing native plants of the South. The economic and horticultural backwardness remained relatively static until the Civil War, and the story of early horticulture in the United States is set almost wholly northward from Baltimore.

Great things began to happen between 1700 and 1750. At Philadelphia John Bartram began his botanic garden in 1728. Throughout his life he explored and collected in the frontier territories from Florida to the Canadian border. His shipments of American plants introduced to

LINNÆAN BOTANIC GARDEN,
FLUSHING.

.New-York, 182

Dear Sir.

I am desirous to extend my collection of Foreign Plants as far as possible, to accomplish whi I am compelled to be dependent on Captains of vessels bound to Foreign Ports, in a great measure, and o th olitenes and attention of many of them, I am under obligations for collections of seeds and plants wh bey have at various times brought me. Should you not consider it too much trouble, your destination will rd an opportunity to you to procure some of the seeds of such plants as are natives of that place, and if y rill procure for me small quantities of every variety of seeds that may be convenient, without regard to fruit flower, together with any bulbous roots you may meet with, you will do me a particular favour, and I shal very willing to remunerate you for them and your trouble, or return you an equivalent in any articles in my blishment, and one or more plants of each kind that I may succeed in raising from the seeds.

Messrs. T. & J. Swords, No. 99, Pearl-street, will, on your return, receive any seeds. ke ou may have for me, and also any communication you may have to make on the subject. I shall be happ o show you all the various trees and plants that are in my garden, (which have been collected from m every part of the Globe,) at any time you may find it convenient to visit it.

With respect.

WILLIAM PRINCE.

Massachusetts Horticultural Society

An open letter to sea captains from nurseryman William Prince in the 1820's. Early American gardeners received some of their most interesting plants from distant countries through this source.

English gardeners and botanists floral riches beyond anything they could have dreamed. Linnaeus called him the greatest naturalist in the world.

First Commercial Nursery

At Flushing, New York, on Long Island, the Prince family opened the first modern commercial nursery in 1737.* For more than a century under four generations of the family it, too, was the center of a two-way trade, sending fine American plants abroad and bringing back European novelties. The Princes were also breeders of fruits and roses, and leaders in perfecting horticultural techniques.

At the same time, French settlements spread along the shores of the Great Lakes and down the whole length of the Mississippi Valley. Wherever they went the French carried the varieties of grapes, apples, and pears which they had brought from France. It is said that when Antoine de la Mothe Cadillac founded Detroit he took along an expert to lay out orchards and gardens.

As the fame of the American flora grew, Europeans began to come specifically for explorations of their own. Pehr Kalm, sent from Sweden in 1748, covered the region from the middle and northern colonies into Canada, met all the leading scientific men, and carried back and published enthusiastic reports of what he found.

By this time a few cities had grown large enough to need outside supplies of fruits and vegetables. So we find orchards in New Jersey and truck gardens on Long Island sending supplies to New York City, and Pennsylvania Dutch farms helping to feed Philadelphia. The superb location of Baltimore made it the outlet for growers in Virginia, Pennsylvania, and Maryland. From Baltimore harbor ships carried fruits and vegetables even to Europe, bringing back seeds, bulbs, and scions of grapes and other fruits. Coastwise trade extended to the far South and the West Indies. Traffic in cider and brandy was profitable.

An American seed industry made its debut in Philadelphia when David Lan-

The Prince nursery firm on Long Island had its problems, as is evidenced by this offer of a reward. The firm continued, nevertheless, from 1737 until after 1800, through four generations.

Massachusetts Horticultural Society

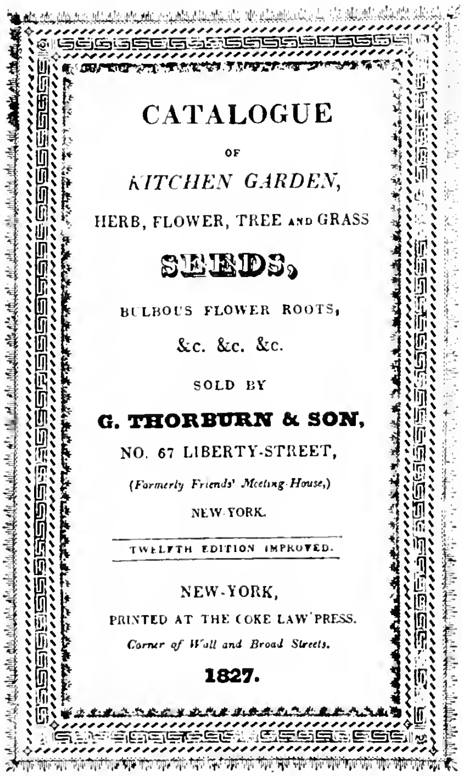
$25 REWARD.

This sum will be paid on receiving proof that will convict the scoundrel that palmed himself off as Mr. Prince, between the 15th and 20th of November, and obtained money intended for me. A young man, from Orange County, misled by the deceptive signs put up by a man named Winter, (who has to make use of another name in order to obtain business) called in there and stated he had come to purchase trees of Mr. Prince. He was kept in ignorance of his mistake, and supposed he was dealing with me, and seventy dollars were obtained from him that were intended for me. He wanted apple trees also, but as they had none, *he was told there were none in the town;* and by this means he was prevented from looking farther, and discovering the deception, which he did not find out till all was completed. The dark and plodding villain who obtained possession of his brother-in-law's home under the garb of pretended friendship, is continually publishing false and deceptive advertisements, stating that he owns this entire establishment, and using the name of "Prince" in a way to deceive the public, whereas it is well known he cannot supply a small order without obtaining articles elsewhere. During the last week two packages of letters sent by me to New-York, and placed in the letter-box of the steamboat *Statesman*, (which is not locked) by Mr. F. Trowbridge, have been stolen therefrom; and last Spring a package of twenty letters sent to me, from the New-York post-office, was also stolen therefrom. I ask if such a warfare is to be tolerated. I have hitherto (at the request of friends) remained as passive as possible, under wrongs the most infamous practiced upon my father and family by a villain:—my sole object being by untiring industry and zeal, to redress the losses of the past. Has this community a proper sense of the acts of this dark-faced hypocrite?

WM R. PRINCE.

Flushing. Dec. 5th

*See C. S. Gager, *The Four Botanic Gardens of Brooklyn.* Long Island Hist. Soc. Quart. Vol. 2, P. 5. 1940.



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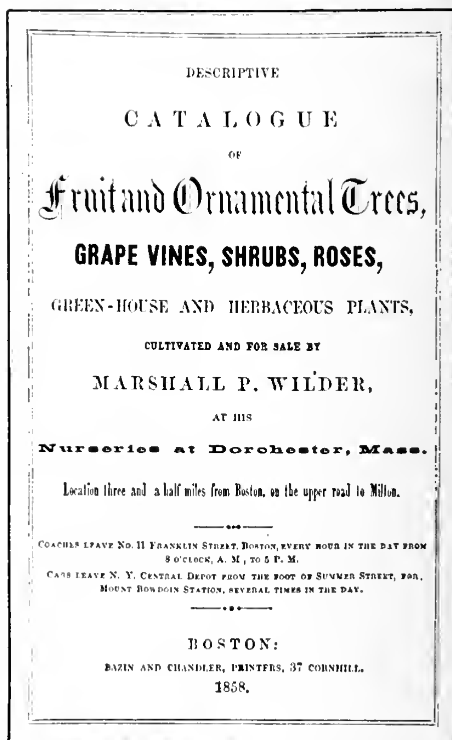
1827.

Grant Thorburn, who in 1802 established the first seed and florist shop in New York City, issued the "twelfth edition improved" of his catalogue in 1827.*

dreth went into business in 1784. Thanks to an unusually favorable climate and to Landreth's progressive ideas, he built up a world-wide trade within a few years. Then the sect of Shakers, whose communities were to be found from New England to Kentucky, began to grow vegetable and flower seeds for sale. Their distribution was limited to what could be reached by horse and wagon from each of their settlements, but their marketing created a precedent. This was the use of small, prefilled paper packets, and a commission arrangement under which unsold stock was taken back at the end of the season.

It seems to have been about this time that American growers adopted the techniques of budding and grafting. Both had been practiced in England long before, but not until 1772 were grafted fruit trees offered here. An advertisement for grafted stock appeared that year in the *Boston Gazette.* In 1791 the Prince catalogue listed 29 peaches "all inoculated" (*i.e.* budded) and in 1794 John Kenrick also changed from seedlings to grafted stock.

In all phases of horticulture there was, from the beginning, a time lag of nearly a century between England and America in the acceptance of new practices. This was due in part to the isolation of America, in part, no doubt, to local conservatism. Although the soils and climates of the New World were quite different from



DESCRIPTIVE

CATALOGUE

OF

Fruit and Ornamental Trees,

GRAPE VINES, SHRUBS, ROSES,

GREEN-HOUSE AND HERBACEOUS PLANTS,

CULTIVATED AND FOR SALE BY

MARSHALL P. WILDER,

AT HIS

Nurseries at Dorchester, Mass.

Location three and a half miles from Boston, on the upper road to Milton.

COACHES LEAVE NO. 11 FRANKLIN STREET, BOSTON, EVERY HOUR IN THE DAY FROM 8 O'CLOCK, A. M., TO 5 P. M.

CARS LEAVE N. Y. CENTRAL DEPOT FROM THE FOOT OF SUMMER STREET, FOR, MOUNT BOWDOIN STATION, SEVERAL TIMES IN THE DAY.

BOSTON:

BAZIN AND CHANDLER, PRINTERS, 37 CORNHILL.

1858.

It was in the vicinity of Boston in the mid-19th century that Marshall P. Wilder had his nursery. As a man of wealth he influenced horticultural trends.

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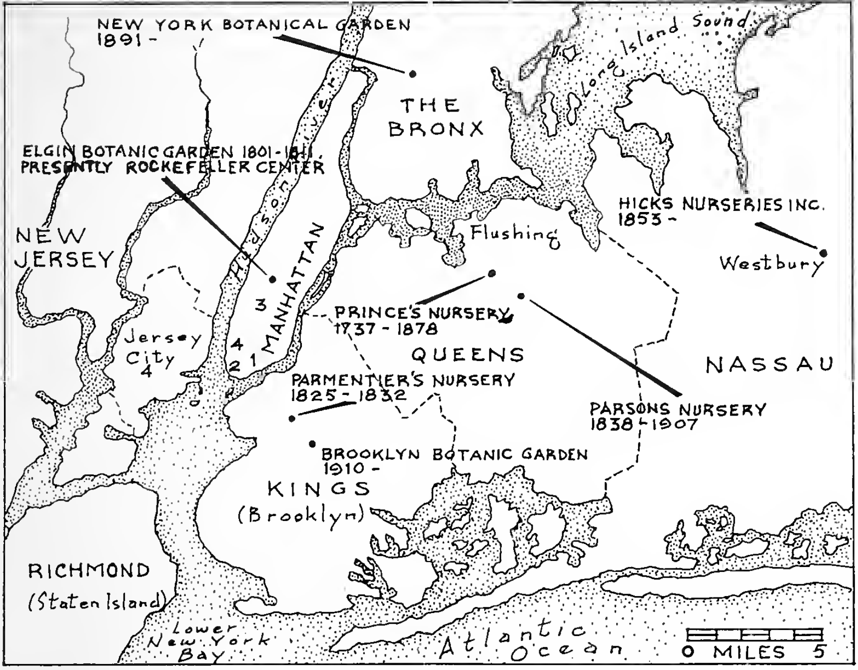
* Early catalogue covers are from collection of Massachusetts Horticultural Society.



Henry B. Aul

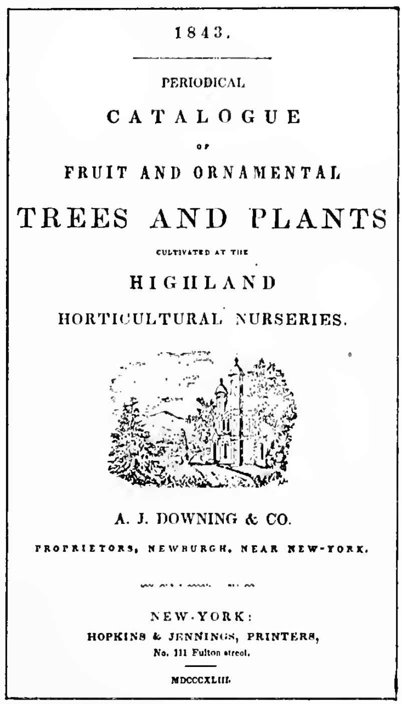
Locations of early nurseries and more recent public gardens in the New York area.

those of the Old, it was not until the early 19th century that an American way of gardening evolved.

Roads Aid Agriculture

Until the Revolution only towns on the seacoast or on navigable rivers had much contact with the outside world. Then in 1775 the Continental Congress decided to build a network of post roads. Although inspired by the needs of the war, this action opened up the country to economic progress otherwise impossible. By 1787 a connecting system joined Concord, New Hampshire to Augusta, Georgia, and a branch went west to Pittsburgh. At last farmers could have access to city markets, improvements in farm management were made profitable, and both cities and farms reaped the benefit.

With the end of the Revolutionary War restlessness was in the air. Settlers moved westward, and the Mohawk Valley of western New York State was discovered to be ideal farm and fruit country. Its progress was constant. In the great Northwest Territory, too, the opportunities for better farms and more indepen-



1843.

PERIODICAL

CATALOGUE

OF

FRUIT AND ORNAMENTAL

TREES AND PLANTS

CULTIVATED AT THE

HIGHLAND

HORTICULTURAL NURSERIES.

A. J. DOWNING & CO.

PROPRIETORS, NEWBURGH, NEAR NEW-YORK.

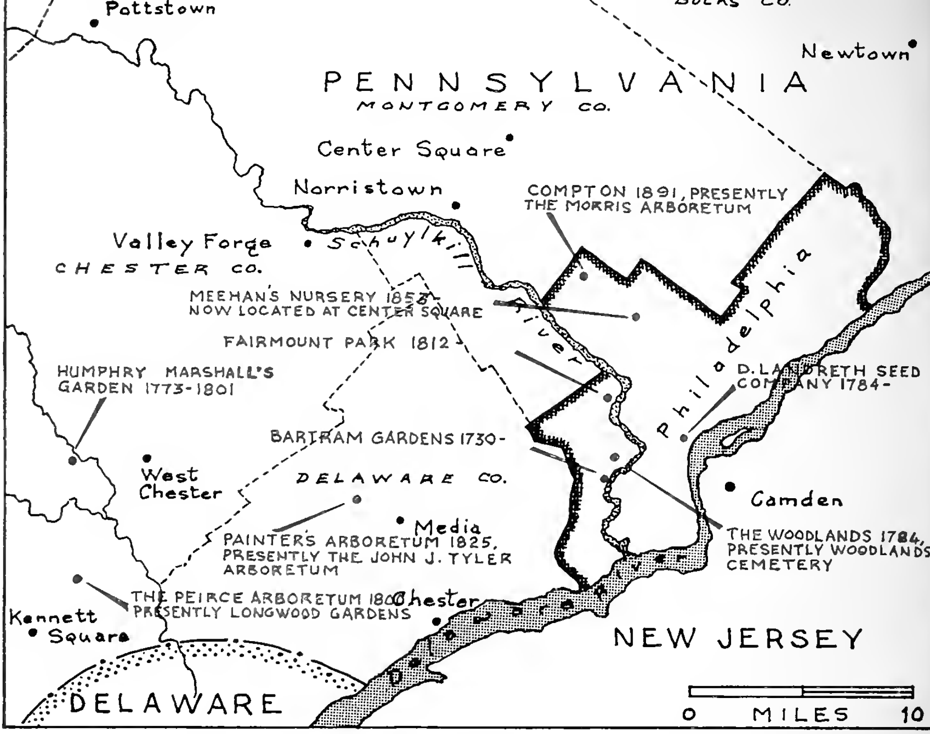
NEW-YORK:

HOPKINS & JENNINGS, PRINTERS,

No. 111 Fulton street.

MDCCCXLIII.

Informal ornamental plantings in the eastern United States were introduced largely through the influence of Andrew Jackson Downing of Newburgh, New York. The cover of his catalogue of 1843 is shown here.



Henry B. Aul

Early public gardens, arboretums, nurseries and seedsmen in Philadelphia and its environs.

dence attracted men who were growing discouraged by the worn-out farms of the East.

In 1786 the French government sent an exploring party, headed by André Michaux. He established a botanic garden near Charleston, S.C., and for 15 years he and his son, François André Michaux, made it the assembly point for the plants they collected. Their explorations took them far and wide, from Florida and the Bahamas in the south to Montreal and Quebec on the north, and westward to Kentucky, Indiana, and Illinois. They are said to have sent back some 60,000 living plants to Europe, as well as large quantities of seeds. The arrangement was both give and take, for they brought in exchange many fine European things, and are credited with introducing the azaleas for which Charleston has since been famous.

Ornamentals Appear

With the 19th century, horticulture at last began to emerge from agriculture, for people had more time and more interest in modest luxuries. The growth was slow, but a few new tree nurseries and seed firms opened, and they carried larger stocks of ornamental plants. Grant Thorburn opened the first seed and florist shop in New York in 1802, Bernard M'Mahon did the same in Philadelphia in 1806. M'Mahon's catalogues were remarkable, for he offered no less than 1000 species, including fine importations from England and the best of the American natives. He may or may not have carried them all in stock, but they were on record. No doubt he knew where he could get them should orders be received. M'Mahon's place seems to have been like a local botanical club, for the large circle of plantsmen in Philadelphia gathered there regularly, and the Lewis and Clark Expedition is said to have been planned at his house.

Such florists' shops as Thorburn's and M'Mahon's appeared slowly in other towns, but there probably were not more than 100 all told. Their greenhouses contained at most 50,000 square feet of

glass. In them pot culture was standard, and the use of beds and benches was still 50 years in the future.

In 1803 the Louisiana Purchase added to United States ownership the great mid-continent west of the Mississippi. No time was lost in exploring it, for Lewis and Clark made their historic crossing of the continent to the Pacific in 1804-1806. The seeds and specimens of hundreds of new and fine plants from their collecting went to M'Mahon and Landreth for propagation and introduction.

Conditions in the South remained static. Only Virginia and Maryland, being exposed to northern influence, had prosperous farms and a successful truck garden industry. Charleston was the only thriving port. Just one horticultural event is worth noting—the introduction of the grapefruit into Florida in 1809. Grapefruit and oranges were the only citrus fruits grown there until after the Civil War.

Patrons of Horticulture

The growing prosperity of the country is made plain by the rise of another new influence in the realm of gardening. This was the patronage of the wealthy. Such men as William Coxe in New Jersey, Marshall P. Wilder in Boston, and Nicholas Longworth in Cincinnati could do things never before possible for private individuals. They were no superficial dabblers, but knew as well as the professionals the needs and the challenges of the times. They had their grounds laid out in the new landscape style; they took an active leadership in fruit breeding; they cultivated such hobbies as fine greenhouse plants, or breeding camellias (the fashionable specialty of the day). They encouraged nurserymen to import fine ornamentals, of which the Lombardy poplar, the Norway maple, and the ailanthus are typical—though not prized today.

Under their leadership, agricultural and horticultural societies began to appear. These were both social and scientific in function, encouraging experimentation, staging exhibits, offering important awards, and publishing research papers.

Seeds From Abroad

Some of the magazines printed surveys of the state of horticulture and letters from travelers. From them we get choice bits of detail which help to fill in the picture of gardening in America in the years approaching the Civil War. The federal government encouraged its consuls abroad to send back seeds of new or superior kinds of plants. These, when collected in reasonable quantity, could be sent free to interested citizens, and from them such valuable introductions as the Navel orange came in.

Reports from the Ohio Valley show that commercial horticulture, especially vineyards and apple orchards, was flourishing, with the encouragement of the Cincinnati Horticultural Society. The Rev. Henry Ward Beecher of Indianapolis used his talents and enthusiasm to the lasting benefit of horticultural progress throughout the Valley area.

Immigrant Gardeners

English gardeners who planned to emigrate to America were given practical advice on prospects for employment. They would succeed if they really knew their business and were not afraid of hard work. There was, however, prejudice against the "haughty ways" of the English, and considerable suspicion of "book learning." With no aristocracy to employ large staffs, estate work meant one or two at most on a place. On the whole, men had to work for themselves. In Thorburn's pungent phrase, "every tub must stand on its own bottom."

During the 1820's and '30's the magazines included some special comments on the great centers. Boston, they said, was fifty years ahead in the number of "attractive villas," in fondness for rare plants and in the forcing of fruits. New York was "immersed in business" but some good gardens were to be found in Brooklyn. Philadelphia came first in interest in fine exotics and in the number of commercial greenhouses.

The opening of the Erie Canal in 1825

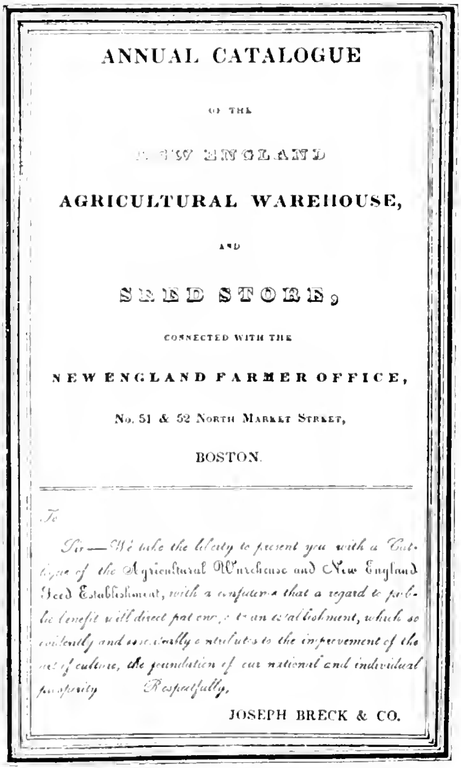
gave the Mohawk Valley direct transport by water from the Great Lakes across New York State, down the Hudson to New York City and the Atlantic. Formerly an inland and local center, it thus had opened to it unlimited markets for its fine products. In 1836 the Long Island (New York) Railroad was put in operation. Now the gardeners and fruit growers who served New York City could get their produce to market in hours instead of days.

In Washington in the same year an Agricultural Commissioner was added to the staff of the U.S. Patent Office in the Department of State. This was the modest beginning of the United States Department of Agriculture. American commerce reached every corner of the world, and in Downing's words "placed in our possession a great proportion of the floral treasures and novelties."

For the next twenty years transportation was the key to horticultural progess. Other railroads penetrated into the west, and Hovey reported that "plants are now disseminated as rapidly over half the Union as they were in former years in the immediate vicinity of our large cities." Then, too, the ease of travel by boat or train led to more visits of individuals for the purpose of buying new and fine plants. What were once outlying towns became suburbs of the cities, and this, too, promoted public interest in gardening. Even Atlantic crossings were faster, for in 1844 "many plants were received in less than 15 days average voyage from Liverpool to Boston."

"English Park" Style

This great era saw at its start the introduction by Andrew Jackson Downing of the new "English park" style of



ANNUAL CATALOGUE

OF THE

NEW ENGLAND

AGRICULTURAL WAREHOUSE,

AND

SEED STORE,

CONNECTED WITH THE

NEW ENGLAND FARMER OFFICE,

No. 51 & 52 North Market Street,

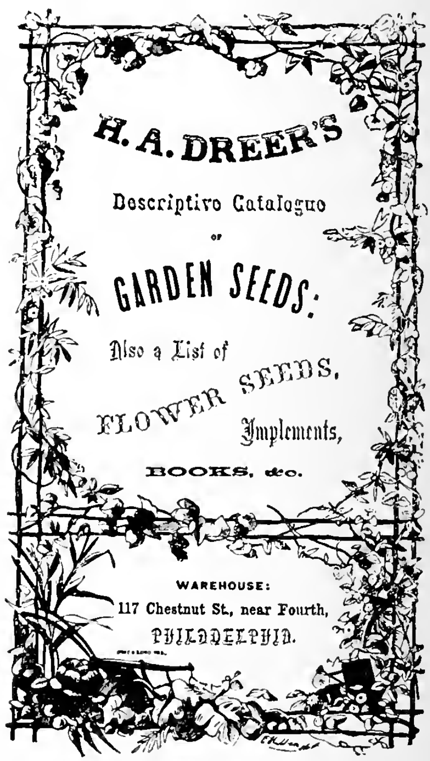
BOSTON.

To

Sir,—We take the liberty to present you with a Catalogue of the Agricultural Warehouse and New England Seed Establishment, with a confidence that a regard to public benefit will direct patronage to an establishment, which so [illegible] contributes to the improvement of the art of culture, the foundation of our national and individual prosperity. Respectfully,

JOSEPH BRECK & CO.

This Breck catalogue from Boston dates from 1840. Established in 1818, the firm is still in business.



H. A. DREER'S

Descriptive Catalogue

OF

GARDEN SEEDS;

Also a List of

FLOWER SEEDS,

Implements,

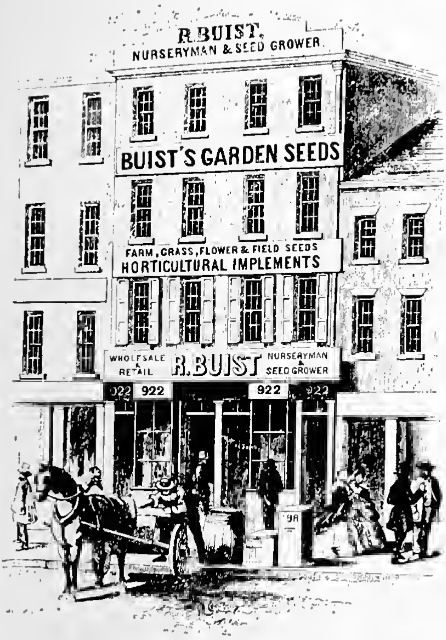
BOOKS, &c.

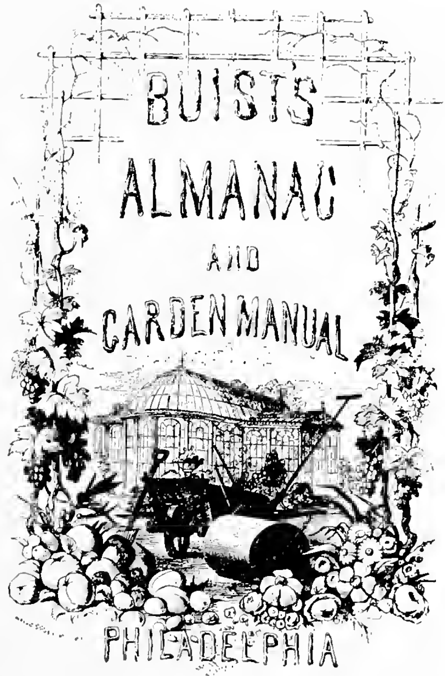
WAREHOUSE:

117 Chestnut St., near Fourth,

PHILADELPHIA.

The Philadelphia firm of H. A. Dreer, started in 1838, was also long-lived. This catalogue is dated 1860.





In the day of hoop skirts and top hats as street attire, Robert Buist had an elaborate establishment in Philadelphia. His 1859 catalogue shows him as purveyor of many types of plants for both garden and farm culture. The size of this and of most of the other catalogues pictured here is about 4½ by 7 inches.

planting, to replace the formal settings of Georgian times. Use could be made of the many beautiful trees and shrubs offered in nursery catalogues. This, unfortunately, did not happen overnight, for though they were well known abroad, conservatism made them accepted slowly by the American public. The result was for many years an unfortunate monotony and mediocrity of planting.

The long years of work with fruits, on the other hand, were at last providing the country with grapes, apples, pears, etc., bred to suit local conditions, improved in flavor and keeping qualities. Thanks to the researches of several English scientists, cultural techniques were advanced. This was especially true of propagation and hybridization, both based on new investigations in the field of plant physiology.

Expansion of settlement westward brought the mid-continent into closer touch. A correspondent in Cincinnati reported it to have "the natural climate" for apples and Indian corn, and many would-be growers were taking up land. Their success might be little, for "many have the impression that they shall . . . sit still and let the trees grow, do little and sell much." In Indianapolis there were several nurseries, but there was so little progress in clearing that stumps of trees were still in the streets. "First comes extermination, then scorching summer suns, and too late the wish that the trees had been spared, and at last planting begins."

In the decade before the Civil War the number of nurseries and their geographic distribution grew. Trends already established continued. Then came the years of the War, the almost complete disruption of ordinary pursuits, and in the years following it a new story of expansion, discovery, and advance. ◆

THE INTRODUCTION OF PLANTS FROM EUROPE TO AMERICA

Donald Wyman

Arnold Arboretum

Smoke-tree (*Cotinus coggygria*) was listed in the Prince nursery catalogue of 1790. (Shown in the center here is the variety *purpurea*.)

THE early Spanish explorers, who are credited with bringing the peach with them to the Southeast in the 15th century, were the first Europeans to transport plants to the new continent of North America. Many of the early colonial settlers in the North also carried plants to America from their native lands, for naturally, in the new country, they would want to grow things with which they were familiar in the old. Fruit trees and medicinal herbs had high priority, but there were ornamentals, too. The apple, pear, plum, lilac, boxwood, European snowball and English yew were known to be growing in New England by 1638, just 18 years after the Pilgrims landed.

In Williamsburg, Virginia, many a landowner built both home and garden to simulate those of England, importing many plants directly from Europe. Before 1752 the horse-chestnut, European birch, cedar-of-Lebanon, English beech, English holly, Scotch pine, European mountain-ash or rowan tree, the European linden and the English elm were thriving there.

Undoubtedly many a European plant was grown in the Philadelphia area also. For some of the plant records of the 18th century we have John Bartram to thank. He, however, was especially interested in native American plants, and in the middle and late 1700's he traveled up and down the Eastern Seaboard exploring for new kinds. Rich English landowners thus obtained many new plants from the wilds of America for their English gardens, and they were continually sending him orders and grants of money for additional

plants. European growers used his services increasingly. When he became American botanist to George III, he gained much prestige among his European correspondents. As a result of his activity he received European plants in return for the American ones he shipped overseas.

As increased attention was given to garden improvement in America, the nurserymen of those times brought in more and more plants from Europe. The catalogue of William Prince of Flushing, Long Island, in 1790 listed many European fruit trees and others such as the smoke-tree (*Cotinus coggygria*), bladder-senna (*Colutea arborescens*) and laburnum (*L. anagyroides*). Asiatic plants, including the goldenrain-tree (*Koelreuteria paniculata*) and rose-of-Sharon (*Hibiscus syriacus*), were also introduced from Europe by the same means. William Hamilton, owner of a large estate in Philadelphia, is credited with bringing to America the first Lombardy poplar in 1784. Siberian plants such as Tatarian honeysuckle (*Lonicera tatarica*), Siberian pea-tree (*Caragana arborescens*), Tatarian dogwood (*Cornus alba*) and the Siberian crab (*Malus baccata*) were undoubtedly among the plants being newly grown in America at this time.

The shining red fruits of Tatarian honeysuckle have been part of the American garden since the late 18th century.

Arnold Arboretum

Brooklyn Botanic Garden

The golden-chain tree or laburnum of southern Europe has been grown in America since early colonial times.

About 1827 all U. S. consuls were asked by the President of the United States to send rare seeds and plants to Washington, where they could be grown for later distribution, but the emphasis was on economic plants, not ornamentals. Even after an office of plant introduction was established in the U. S. Department of Agriculture (1898) it was many years before ornamental plants received attention; so throughout the 19th century, it was the nurserymen of the Eastern United States who were chiefly responsible for furnishing gardens with European plants. Parsons Nursery of Flushing, Long Island, which was a going concern in 1840, was widely known for its great assortment of European plants. Thomas B. Meehan of Philadelphia, established in 1853, was another and the great Ellwanger and Barry Nursery of Rochester, New York, was a third. There were others, too, but these are names still remembered when "new" European plants are thought of.

Beginning about 1861, there was a new and expanding interest in plants from Japan, but with European nurserymen looking for fresh sales outlets, and rich Americans traveling in Europe far more

than in the Orient, interest in European plants did not lag. Wealthy Americans who owned large estates, especially in the East and South, were buying privately to increase their own collections.

Mr. H. H. Hunnewell of Wellesley, Massachusetts, was one such wealthy landowner who was importing large numbers of forest trees, fruits and evergreens from Europe by 1846. His diary showed that in 1847 he imported 2,060 trees from England, including European species of *Abies, Acer, Betula, Fagus, Ilex, Laburnum, Larix, Populus, Picea, Pinus, Quercus, Sorbus, Tilia, Ulmus* and *Ulex*. His losses were high because he had practically no information concerning the hardiness of these new plants in America. He had to approach the problem by the costly method of trial and error, but fortunately he was rich enough to absorb the losses and try many of the plants a second and even a third time. Several dwarf varieties of the Norway spruce (*Picea abies*), as well as numerous rhododendrons and azaleas, were among the many plants that may have been introduced from Europe for the first time by him.

As early as 1856, Mr. Hunnewell became interested in rhododendrons and started to import them from Europe. Ten years later he bought many from Waterer's Nursery in Woking, England, the object being to attempt to grow all the varieties of the evergreen rhododendrons available in Europe and in England at the time, each variety usually being planted in large numbers. Here again he had little knowledge of the hardiness of these plants, many of which he kept in "cold houses" over the first few winters until he knew more about their resistance to the climate. His losses must have been extremely heavy for he noted in his diary that during the winter of 1872 many of his rhododendrons were killed. Some of them had been growing out-of-doors for 10 to 15 years and were 10 feet high at the time.

The great rhododendron show for which Mr. Hunnewell was largely responsible was staged under canvas on Boston Common in 1873. It was the first show to feature evergreen rhododendrons in America and this did much to promote interest in these flowering shrubs throughout the entire Eastern United States. This was followed three years later in Philadelphia, during the centennial celebration of 1876, by an outstanding exhibit of 1,500 rhododendrons from Waterer's Nursery in England. But to Mr. H. H. Hunnewell should go the credit of realizing the ornamental potentials of these European hybrids and for first bringing many of them to America for display.

With the establishment of the Arnold Arboretum in 1872, a new impetus was placed on the introduction of plants from abroad. Of course, the first few years were ones during which the small staff of the new arboretum was overcoming many problems, natural as well as financial, to set itself up as a plant growing establishment. However, its young director, Charles Sprague Sargent, was filled with enthusiasm and soon started corresponding with many European people, obtaining new plants and seeds for his rapidly developing establishment.

Professor Sargent made his first trip to Europe in the spring of 1874. During this year he obtained many seeds from the Royal Botanic Gardens at Kew and from the Imperial Garden of what was then called St. Petersburg in Russia. His records show that during the fiscal year (July 1, 1875, to June 30, 1876) 56 plants and 264 packets of seed were received from Great Britain alone and 307 plants and 1,620 packets of seed were received from Europe. All this only two years after the Arnold Arboretum was started!

The last part of the 19th century and early part of the 20th were years of great activity in European nurseries. The German nurseries of Hesse & Spaeth and the great nursery of Veitch in England were actively engaged in plant introductions as well as plant hybridization. Victor Lemoine and his nursery in France were especially outstanding. As a result of Lemoine's efforts and those of his family

Arnold Arboretum

The floriferous Siberian crab apple *(Malus baccata)* was brought to America by way of Europe at a very early date. In recent years the Arnold Arboretum has introduced several distinctive varieties.

who carried on the business later, many new hybrids in such genera as *Deutzia, Philadelphus* and *Syringa* were originated. Professor Sargent of the Arnold Arboretum usually found out about such new introductions and obtained them at once. As has always been the policy of the Arnold Arboretum, worthy plants were later propagated and distributed to interested commercial nurseries in America.

During this period of few import restrictions, many people undoubtedly brought back plants with them from their travels. For instance, Alfred Rehder of the Arnold Arboretum staff happened to see some English ivy growing near the Baltic Sea in 1907. This, he figured, must be hardier than other kinds. So he brought a few cuttings back to America and named the plant *Hedera helix baltica.* Today this variety is widely grown and highly recommended for the colder parts of the United States where the species itself does not survive. Another special trip to the Baltic region, sponsored by the Arnold Arboretum in 1934, resulted in some hardy introductions of boxwood and privet.

The Arnold Arboretum soon earned an international reputation for the introduction of plants, and it has continued this work ever since. Two other institutions to which credit is due for actively seeking European plants since the late 1940's and 1950's are the Morton Arboretum of Lisle, Illinois, established in 1923, and the University of Washington Arboretum in Seattle, established in 1935.

Obviously, there are long gaps in this history of European plant introduction. Nurserymen and private individuals have aided the cause greatly, certainly up until 1918 when Plant Quarantine 37 first became effective.

It soon became increasingly evident that woody ornamentals which were "pro-

hibited" entry into the United States unless they were grown in specially built bugproof plant houses, were not being imported. Apparently the U. S. Department of Agriculture needed to place more emphasis on economic plants than it could on purely ornamental plants, with the result that ornamental plants on the "prohibited" list were not being introduced.

The Plant Patent Act, which went into effect in 1931, put a new impetus on the "discovery" of new plants, and some European plants were immediately patented once they reached America. Such was the case with *Acer platanoides* 'Crimson King', patented May 6, 1947 (#735). This originated in France, but was patented in this country by the Gulf Stream Nursery, Inc., Wachapreague, Virginia. Now widely used throughout the United States, it exemplifies one way in which European plants have been made at home in America.

Well informed nurserymen like Jacques le Gendre of the Gulf Stream Nursery have made many trips to Europe in the last several decades, searching for new plants to introduce to the United States. Frank L. Skinner of Skinner's Nursery, Ltd., Dropmore, Manitoba, Canada, has sought European plants for introduction to the colder parts of Canada. Many others have performed similarly.

In 1953, the Arnold Arboretum activated a program with other arboreta of the country, in cooperation with the Bureau of Plant Introduction, headed at that time by Dr. C. O. Erlanson. It was agreed that plants would not be ordered from Europe which were known to be growing some place in the United States. The Arnold Arboretum staff had to do considerable work before contemplated orders were submitted to the USDA for scanning. Plants were ordered directly from European nurseries and eventually paid for by the arboreta requesting them. They were shipped under special permit from Europe directly to the Plant Introduction garden at Glenn Dale, Maryland, where they became the property of the U. S. Government. This meant that they could be propagated if desired or destroyed if infested with pests, but at the end of the two-year quarantine period they would be released to the arboretum buying them in the first place, if there were no complications with contamination by diseases or insects.

As a result, nearly 1,000 kinds of so-called "prohibited" ornamental woody plants were thus admitted to the United States between 1953 and 1960. Although not entirely superseded by the program sponsored cooperatively by the Agricultural Research Service of the Department of Agriculture and Longwood Gardens,* the Arnold Arboretum has not been as active in the last six or seven years as it was formerly when no other group was actively introducing plants.

The Arnold Arboretum again sponsored a special search of European gardens and arboreta in 1965, as a result of which nearly 1,000 woody plants were introduced, some for the first time. Some were replacements of rare specimens which had died, but throughout all these years, this institution has been consistently introducing plants from Europe. Some brought over between 1948 and 1956 are *Cotoneaster horizontalis* 'Little Gem', *Euonymus europaeus* 'Red Cascade', *Liriodendron tulipifera* 'Contorta', *Mahoberberis aquicandidula, Mahoberberis aquisargentiae, Malus* 'Golden Hornet', *Malus* 'Upton Pyne', *Potentilla fruticosa* 'Jackman's Variety', *Rosa moyesii* 'Sealing Wax', *Rosa moyesii* 'Geranium', *Symphoricarpos* 'Mother of Pearl', *Viburnum plicatum* 'Lanarth'.

European nurseries are none too anxious to cope with U. S. plant quarantines, which are getting more strict all the time. However, even now some American commerical growers are buying large amounts of certain non-restricted plants from Europe, especially from The Netherlands. American gardeners owe a great debt to the hundreds of European growers and hybridizers who have been growing, breeding and selecting outstanding ornamental plants for centuries. ◆

* For a description of this program see the article by John L. Creech on page 50.

PLANT EXPLORATION IN THE EASTERN UNITED STATES

Nesta Dunn Ewan

THE eastern part of the United States was the object of continual exploration by plantsmen beginning in the late 1500's. The first to concentrate specifically on eastern natives for cultivation was John Tradescant,[1] * who made several trips between 1632 and 1654. He took back to his father's gardens in and about London the seeds or plants of about one hundred species from the lower York River area of Virginia, one being "beare's ears" (*Dodecatheon meadia*).

The economic plants of the Indians of Florida had reached Europe through the Spanish who had also taken back sassafras and the cardinal-flower, and of Virginia by the party of Hariot[26] and John White[22a] from the Roanoke area in 1585-87. White had painted a *Sabatia* and a milkweed. *Robinia pseudoacacia* may already have reached France, probably from the expedition of Laudonnière and Ribault[26] into the southern Appalachians shortly after 1565.

The Reverend John Banister,[16] Oxford-trained naturalist, explored for new species in the James River area from 1678 to 1692. He made known to the Oxford Physick Garden and the famous garden of Henry Compton, Bishop of London, the sweet-bay (*Magnolia virginiana*), hop-hornbeam (*Ostrya virginiana*), huntsman's horn, a pitcher-plant (*Sarracenia flava*), swamp azalea (*Rhododendron viscosum*), and several irises among about 340 species. He undoubtedly presented a few rarities to his friends, William Byrd I, Theodorick Bland, Edwin Randolph, and John Custis II, prominent early Virginia planters and government administrators. The Reverend Hugh Jones, who came to Maryland as chaplain to Governor Nicholson, then William Vernon and David Krieg searched the southern parts of Maryland in 1696—1698, one of them finding the Indian-pink or pink-root (*Spigelia marilandica*).

Buhle

Nyssa sylvatica, which goes by such varied common names as tupelo, pepperidge, sour-gum and black-gum, was one of Mark Catesby's 18th-century introductions from America into English gardens.

Southern Natives

Mark Catesby[19] botanized along the James, York, and Rappahanock rivers from 1712 to 1719, and in the Carolinas, 1722—1725. He re-collected the Indian-pink, sending it to England where some time later Philip Miller reported in *Gardener's Dictionary* that in the Chelsea Physick Garden it grew but slowly, did

* See: Suggestions for Further Reading, page 25.

not set seed, and should not be transplanted often. Catesby also sent plants to Thomas Fairchild, who had a nursery at Hoxton, and, among others, to Peter Collinson,[33] London Quaker merchant. Catesby no doubt also introduced novelties into the Williamsburg gardens of his sister, Elizabeth Cocke, and of John Custis IV, William Byrd II of Westover, and of John Clayton,[6] clerk and botanist of Gloucester County who had a fine garden on the Piankatank River.

The catalpa first grew successfully in England from Catesby's seed, and through his, and later the Bartrams' efforts, was soon growing from the Carolinas northward along the Atlantic coast, even as far north as a sheltered spot in a garden of French officers in Ticonderoga, New York, in 1775. In that garden also grew another of Catesby's introductions, the laurel-leaved magnolia (*M. grandiflora*), which had been grown in England as early as 1737.

Among Catesby's other introductions into the gardens of English friends were the tupelos (*Nyssa sylvatica*, pepperidge or black-gum, and *N. aquatica*, cotton-

The Catawba rhododendron was discovered by André Michaux before the end of the 18th century. Along with mountain-laurel (shown on opposite page) it is regarded as one of the handsomest of native American shrubs.

Gottscho-Schleisner

Genereux

Franklinia, first discovered by John Bartram on the Altamaha River in Georgia in 1765, was last seen in the wild by the nurseryman John Lyon in 1803.

gum), the honey-locust (*Gleditsia triacanthos*), cassine (presumably *Ilex vomitoria* but possibly *Ilex cassine*), "pear-berried hawthorn" (*Crataegus flava*), smooth sumac (*Rhus glabra*), French-mulberry (*Callicarpa americana*), *Gilia rubra, Wisteria*, the rosebay (*Rhododendron maximum*), and mountain-laurel (*Kalmia latifolia*), of which Catesby wrote: "As all plants have their peculiar Beauties, 'tis difficult to assign to anyone an Elegance excelling all others, yet considering the curious Structure of the Flower, and beautiful Appearance of this whole Plant: I know no shrub that has a better claim to it." Although Catesby's seeds and plants of *Kalmia* did not thrive, John Bartram's, sent to Collinson and to Catesby, flowered in England.

John Clayton brought novelties from as far away as the Blue Ridge to his Virginia garden to study for his *Flora*. Although he sent his most impressive discovery, silky-camellia (*Stewartia malacodendron*) to Catesby, then in England, most of the many plants he found were sent to the garden of George Clifford in Hartecamp, Holland, where they were studied by Jan Gronovius of Leiden, and

were given systematic names by Linnaeus.[20]

From 1629 to 1633 William Wood observed useful New England plants, and John Josselyn[23] from 1638 to 1639 and 1663 to 1671, but they seemed content to leave them in the wild although Josselyn mentions taking *Pyrola* to try in England only to have it die on shipboard. Manasseh Cutler first explored the White Mountains of New Hampshire in 1784, and again in 1804 with William Dandridge Peck. The trip produced the bearberry willow (*Salix uva-ursi*) sometimes grown in rock gardens.

Almost from the beginning there had been those who landscaped by sparing the loveliest and grandest of trees on the homesite, along with a flowering shrub or two, dogwood or wild rose, and wild grape to clamber over the rail fence. Some even dug a clump of fragrant iris, bulbs of the Canada lily, or gathered seed of brilliant lobelia or phlox to scatter in the dooryard, but interest in native plants as garden subjects received particular stimulus from Collinson when he found that John Bartram[2] was willing to send him new garden subjects.

Gottscho-Schleisner

The large-flowered evening-primrose (*Oenothera grandiflora*), another Bartram discovery. In accordance with the Bartram custom, it was sent to England, where it is believed to be more widely grown today than in its native home.

Genereux

Mountain-laurel (*Kalmia latifolia*) was discovered by Mark Catesby in Virginia, but the first seeds to develop into flowering shrubs were some that John Bartram had sent to England.

Farmer John Bartram

For two years farmer Bartram had been developing a garden of natives on the Schuylkill River near Philadelphia, and had taught himself enough Latin so he could understand current botanical books. In 1730 Collinson contracted with Bartram to send him seeds "100 species in a box at five Guineas each," and found other patrons, particularly Lord Petre, who helped make longer trips possible. From 1735 through 1766 John Bartram explored, sometimes with his son William[2,3] from Oswego on Lake Ontario to St. Johns River, Florida, and as far west as Pittsburgh.

Although he kept journals of each of his major trips, only that of 1765-66 survives, and so it is difficult to determine just where and when he first found particular plants. In tracing the Schuylkill to its source he found a "stately martagon" (*Lilium philadelphicum*), and in the mountains of western Pennsylvania while looking for white cedar he found white and red shrub-honeysuckle, a Solomon's-

seal, a new goldenrod, and sweet-flowering white locust. Along the James and again on the Hudson he rediscovered arborvitae (*Thuja occidentalis*), and in the Catskills he gathered cones of balsam fir. While in Pittsburgh he was presented with "curiosities," among them a decorative African cucurbit (*Momordica charantia*) and brought home a new gooseberry from Conestoga. White cedar, Weymouth (white) pine, spirea, baneberry, maidenhair fern, milkweeds, *Calopogon, Erythronium, Claytonia, Chelone,* fringe-tree and chinquapin were grown in his garden for Americans and Englishmen.

Franklinia and Pinckneya

From near Ft. Barrington, Georgia, came the Bartrams' most spectacular discoveries: *Franklinia* and *Pinckneya,* and William found purple anise (*Illicium floridanum*), water-lettuce (*Pistia stratiotes*), large-flowered evening primrose (*Oenothera grandiflora*), "*Magnolia pyramidata,*" *M. fraseri, M. macrophylla,* oakleaf hydrangea (*Hydrangea quercifolia*) and the lovely lady lupine (*Lupinus villosus*). Some that they tried at home or sent to Collinson and William's patron, John Fothergill, were difficult to establish, *e.g.,* the stately lotus (*Nelumbo lutea*); some survived only under the most skilled care, *e.g.,* trumpet flowers, and "tipitiwhitchet" or Venus flytrap; and some unrecognized hemi-parasites would not grow, *e.g.,* conjuring-nut (*Nestronia*) and Indian paint-brush (*Castilleja*).

Gottscho-Schleisner

Venus flytrap *(Dionaea muscipula),* though of little interest as an ornamental plant, was a rewarding discovery of the Bartrams. The hinged leaves snap together when an insect alights on them, and the body juices are "digested" by the plant. Its only wild habitat is the Great Dismal Swamp of the North Carolina-Virginia border.

Genereux

Oak-leaf hydrangea *(Hydrangea quercifolia)* was among the spectacular Bartram discoveries in Georgia. Although a southern native, it is hardy as far north as Ohio and Massachusetts.

From Charleston, South Carolina, Martha Logan exchanged natives with the Bartrams, in 1761 sending Carolina holly and horse-sugar (*Symplocos tinctoria*); the Henry Laurens and Thomas Lambolls exchanged seed. Stimulated also by Collinson was John Custis IV[33] whom John Bartram after a visit considered as having a garden second only to that of John Clayton in Virginia. From 1734 until 1746 Custis sent natives to Collinson and traded with John Bartram, Clayton, and others. Catesby gave Custis a pink dogwood, and Custis sought black-haws, toothache-tree, larkspur, passionflower—

Genereux

Yellow-wood (*Cladrastis lutea*) is a magnificent, wide-spreading, summer-flowering tree with smooth gray bark much like that of a beech. Though native in the mid-southern states, it is hardy northward. A specimen still standing in the Bartram garden in Philadelphia is believed to have been a gift of Francois Michaux.

two sorts—smooth sumac, and waxberry (*Myrica cerifera*) for his correspondents.

Humphry Marshall,[27] cousin of John Bartram's, aided at periods by his nephew Dr. Moses Marshall, began a botanic garden and nursery of natives near Philadelphia in 1767. The disappointing sale of Humphry's *Arbustum** *Americanum* (1785), which detailed native plants available from his nursery-garden, many of them introduced by the Bartrams, was illustrative of the general lack of interest by Americans in their native plants. Most were satisfied with magnolias, kalmias, rhododendrons, and lilies.

A Student of Linnaeus

Following advice gleaned from chats with John Bartram, Pehr (Peter) Kalm,[24] student of Linnaeus, traveled in 1748-50 through Pennsylvania, New Jersey and New York searching specifically for plants hardy to Swedish winters. From New Jersey he brought the waterlily to the Bartrams, and it was soon growing near their garden. Collinson and Fothergill pressed them again and again for seeds and roots. Linnaeus named *Viburnum lentago* from Kalm's collection, and adopted Kalm's generic name for teaberry (*Gaultheria procumbens*). He described this little aromatic wintergreen plant from two specimens, one of Kalm's, and the other from Cadwallader Colden, whose home on the Hudson nurtured native plants. With his botanist daughter Jane[28] he was host to Kalm, the Bartrams, and Dr. Alexander Garden[11] of Charleston, and corresponded with and sent seeds and plants to Collinson, Gronovius, and Linnaeus during the 1750's.

André Michaux,[34] who had managed forests in France and traveled in Eng-

* In original title, *Arbustrum* (incorrect).—Ed

Gottscho-Schleisner

The sweet-scented white flowers of the swamp azalea *(Rhododendron viscosum)* were first observed in North America by the Reverend John Banister, who came from England to explore for plants during the last quarter of the 17th century.

land, the Pyrenees and Persia, was sent in 1785 by the French government to search for likely introductions. Visits with William Bartram acquainted him with known desirable species, and the routes the Bartrams had traveled. He explored the Northeast and established a growing garden in northern New Jersey, but the following year established one in Charleston for a "more favorable climate." Over the next few years, sometimes accompanied by his son, François André,[34] he searched the Carolinas and Florida, and explored around the southern part of Hudson Bay. Of particular interest is his journey through Kentucky and Tennessee, beyond the routes of the Bartrams, when he reached the westernmost point of settlement at the junction of the Clinch and Holston rivers in March 1796. *Rhododendron catawbiense* was his most spectacular find. Blue ash, false-buckthorn, swamp-privet, and a number of oaks and vacciniums were his additions to cultivated plants.

French and English Explorers

François André Michaux had returned to Paris to study medicine, but after his father's death in 1802, France commissioned him to continue the search for choice American trees and shrubs. He retraced much of his father's routes through Ohio and the Alleghenies, and returned through North Carolina. Pumpkin ash (*Fraxinus tomentosa*) was one of his numerous discoveries. Although the collections of the two Michaux were intended for France, both were generous in their exchanges with Americans. The old yellow-wood (*Cladrastris lutea*) still standing in the Bartram garden was probably a gift from François to William Bartram. He, William Hamilton,[22] and Thomas Jefferson all mention the silk-tree (*Albizia julibrissin*) which André had brought to America.

John Fraser, who had acquired his interest in and knowledge of plants from visits to the Chelsea Physick Garden and Kew, first explored for plants in Newfoundland, then in 1786 came to Charleston. That fall he set out with André Michaux to explore the southern states, but Michaux's horse having been stolen, he proceeded alone. On his second and succeeding six trips to America, the last in 1808, he was usually accompanied by his son, John, who sometimes stayed to manage the nursery in Charleston while a second son managed one in London. Father and son, after climbing all morning through fog on Roan Mountain, came out into the full sun at the summit and were rewarded with a glorious sight of "a large quantity" of *Rhododendron catawbiense* in full bloom. This had earlier been found by André Michaux, and most of Fraser's specialties, even *Magnolia fraseri* named for him by the Carolina farmer and botanist, Thomas Walter, had been found first by others, especially John or William Bartram.

Yellow Honeysuckle

In 1787 Fraser took Walter's *Flora Caroliniana* to London and published it. Walter had grown and studied many of the plants of the coastal area of the Santee River, and Fraser added species from the higher lands to the west, thirty new genera he said. One of Fraser's more

unusual introductions was the yellow honeysuckle (*Lonicera flava*) which had first been mentioned by John Drayton, onetime Governor of South Carolina, who recorded it in his *View of South Carolina* (1802).

John Lyon,[17] a Scot, was gardener at William Hamilton's Woodlands off and on from 1799 until 1806. In that rich collection he learned the American natives, and so from 1802 until his death in 1814 he retraced much of the route of John and William Bartram and of André Michaux, and learned of collecting areas from Fraser. He made two trips to London to sell nursery stock, but from his temporary growing gardens in Greenville, Charleston, and Philadelphia, his novelties found their way into American gardens. From the top of Pilot Mountain he took *Pieris floribunda,* which he lost on the way. The elderly woman who found the mysterious bundle hid it in the woods "from a supposition that it contained something valuable."

Lyon rediscovered the conjuring-nut (*Nestronia umbellula*) found by William Bartram on Great Ridge, Georgia, in 1773. He was the last person known to have seen *Franklinia* in the wild, in 1803. David Landreth, son of the David Landreth who established a successful nursery in Philadelphia, and with whom Lyon boarded in 1813, years later recalled "the Magnolias, Halesias, Stuartias, Virgilias, Gordonias Pinckneyas, and other then rare trees and shrubs, which decorated the old place—they were mainly the contribution of Mr. Lyon." As soon as young David was old enough he was put in charge of a branch nursery in Charleston handling American natives. It thrived until the Civil War.

"Indian Plant Hunter"

Sometime about 1790—1800 the elder Landreth seems to have engaged Matthias Kinn, known as the "Indian plant hunter" because in the wilds he dressed in deerskin, about whom little is known except that he was a German. He concentrated on bringing azaleas from the highlands of the Carolinas and Georgia. Kinn is believed to have been the first successfully to grow *Magnolia macrophylla,* seen and described first by William Bartram in 1775 from the banks of the Altamaha and elsewhere in Georgia and Alabama.

Although Aloysius Enslen maintained a nursery in Philadelphia from about 1800 to 1810 primarily to collect and prepare American natives for shipment to Austrian gardens, he exchanged with other collectors and nurserymen. His copper-colored iris (*Iris fulva*) from near New Orleans, for example, found its way to England in John Lyon's shipment of 1812. In 1804 Enslen collected in the vicinity of Savannah and probably near Lancaster, Pennsylvania. On a trip which appears to have been in 1806 he traveled to Pittsburgh, down the Ohio and Mississippi, stopping at St. Louis, and then continued downriver to New Orleans. Returning north through present Mississippi, he followed the old Coweta Trail through Columbus and Macon to Augusta and Savannah.

Frederick Pursh[14] came from Germany as a trained horticulturist in 1799. During 1803-05 he was at William Hamilton's Woodlands, succeeding John Lyon. Under Professor Benjamin Smith Barton's patronage in 1806 he explored the mountains of western Maryland, proceeding down the valley of Virginia into North Carolina. In 1807 he explored northern Pennsylvania, central New York, and into Vermont. In November, 1807, he moved to the nursery established by Bernard M'Mahon near Philadelphia where plants from seed brought by Lewis and Clark were being grown. There he studied and made drawings, hoping to publish descriptions of the plants. After Clark's untimely death Pursh moved to Dr. David Hosack's Elgin Botanic Garden[28] near New York City and remained until the winter of 1810. To Hosack's garden, which had been established in 1801 for teaching medical students, Pursh contributed natives, and there was a lively exchange between the Garden and Hudson River estates, and perhaps with William Prince, New York nurseryman who dealt in native trees and shrubs.

There was, however, insufficient interest by individuals or by the State of New York to maintain the garden, and Hosack had to abandon it in 1811.

Great Lakes Area

Also befriended by Professor Barton was Thomas Nuttall[21] who arrived in Philadelphia from Liverpool in 1808. He had explored central Atlantic United States and also the Great Lakes area by 1809 when he turned his attention westward before becoming curator of the Botanic Garlen at Harvard in 1822. Nuttall named a western discovery, *Mahonia*, for the pioneer nurseryman, Bernard M'Mahon, and when he returned to England in the 1840's he disposed of his native seed to the Pennsylvania nurseryman, Robert Buist.

William Baldwin,[9] after getting his medical degree under Benjamin Barton, and with particular encouragement from Humphry Marshall, botanized carefully much of the route taken by the Bartrams. From Milledgeville, Georgia, in April 1812, he commented on *Melia azedarach:* "This universal ornamental tree has even found its way into the wilderness." About 1830 John Evans, a miller near Radnor, Pennsylvania, became interested in adapting garden conditions as nearly as possible to those of New Jersey bogs, with sandy spots and rocky ledges, and soon was successful with American and Himalayan plants. Exchanging with Evans were Minshall and Jacob Painter, who developed an arboretum of 500 acres near Media, Pennsylvania (now Tyler Arboretum). A sturdy *Sequoiadendron giganteum* grows there today, the first to succeed east of the Mississippi.

Having lived for some time in New York and Philadelphia after his arrival from Sicily in 1815, Constantine Samuel Rafinesque then taught in Transylvania College in Lexington, Kentucky. On many a long trip he searched for new plants or for rare ones described by others. He gave the name *Cladrastis* to the yellow-wood or virgilia discovered by André Michaux in 1796, and *Prunus coccinea* to William Bartram's plum which

The brilliant orange wood lily (*Lilium philadelphicum*) was found by John Bartram near the source of the Schuylkill River. It grows wild over more than half of the United States.

has since disappeared, perhaps with Pearl River Island at the mouth of the river. It had "an abundance of large crimson fruit, of a very enticing appearance; they are rather tart, yet are an agreeable eating, at sultry noon. . ." In 1817 Rafinesque translated, annotated and added species from William Bartram's *Travels* to the first serious summary of plants of "Louisiana," C. C. Robin's account (1807).

Although the Reverend Moses Ashley Curtis[32] of Hillsboro, North Carolina, explored most of his state for flowering plants, he is especially remembered for making known lichens and fungi, as was his friend and correspondent Henry W. Ravenel[32] of Aiken, South Carolina, who combed the area between the Cooper and Santee rivers. Curtis and Ravenel corresponded in this country with Asa Gray,[13] lichenologist Edward Tuckerman of Amherst, and especially with William Starling Sullivant, who had grown up with an interest in the native flora, particularly the mosses, around newly settled Columbus, Ohio.

In 1849 Auguste Trécul[15] came to search for root crops for France in the

lower Mississippi valley. He made observations on *Magnolia grandiflora.** A small leaved form had early been taken to France for cultivation, and had been reintroduced to New Orleans as a garden plant quite different in aspect from the usual tree growing in nearby swamps.

So it was during these earliest explorations in the eastern part of the country that such stalwart ornamentals as rosebay and Catawba rhododendron, mountain laurel, oak-leaf hydrangea and mountain andromeda were first brought to the attention of the world's plantsmen. ◆

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* The tree had been seen earlier by Mark Catesby at Colonial Williamsburg.—ED.

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Tree Planting Cost—as of 1896

Cost of City Tree Planting.—People of little thought are often surprised that the cost of planting and caring for a tree is largely out of proportion to its first cost. That admirable institution, the Brooklyn Tree-planting and Fountain Society, offers to plant and care for trees when desired to do so by citizens, and gives the following, as approximately the cost:

Cost of Tree (except in exceptional cases)	75c. to $1.50
New Soil, where necessary	1.00
Post and Wire Guard	1.00
Cutting hole in flagging, where necessary	1.00
Iron Plate, when used	1.50
Labor	1.00
Maximum	$7.00

From *Meehan's Monthly* (Philadelphia), June 1896

As of 1967, the cost of planting a street tree in any of New York's five boroughs may be well over $100.

ASA GRAY AND SHORTIA

THE name of Asa Gray (1810-1888) is best known today for *Gray's Manual of Botany,* a great work which has gone through eight editions since it was first published in 1848 and, as revised by Merritt Lyndon Fernald in 1950, continues to be a standard reference work. One of the stories fondly associated with Gray concerns the fine little woodland plant *Shortia galacifolia,* sometimes called Oconee bells, which Gray spent a good part of his life looking for.

In 1839 Gray was in Paris studying the herbarium of the French botanist André Michaux (1746-1802), who had spent considerable time seeking plants in America in the latter part of the 18th century. Gray noticed an unnamed specimen of a flower completely unlike any he had ever seen before. It bore a simple label, *"Hautes montagnes de Carolinie."* Interest aroused, Gray searched North Carolina in vain for the plant. Two years later, and reluctantly, he published a description of the plant based on the Michaux specimen, and named it *Shortia galacifolia* after Kentucky physician-botanist, Dr. Charles W. Short.

Roche

It was 38 years after Asa Gray had first seen a dried specimen of shortia (*S. galacifolia*) that the plant was finally rediscovered in the wild. It is a native of the Carolina mountains. As a rock-garden plant it does best in deep shade.

Gray's interest in *Shortia* never waned. In 1858, nearly twenty years later, he was studying herbarium specimens of the Russian botanist Carl Johann Maximowicz (1827-1891), who had done extensive plant exploring in Japan. Gray's astute eye seized on a plant Maximowicz had named *Schizodendron uniflorus.* Gray recognized it immediately as another species of the *Shortia* he so eagerly sought. To Gray the discovery of the similar Asiatic species gave credence to the theory that the floras of the eastern United States and of Japan had something in common.

In the ensuing years hardly a botanist (and there were many) ventured into the mountains of Carolina without a commission from Gray to search for the little plant. At long last, in 1877, a young man, G. M. Hymans, found *Shortia* growing on the banks of the Catawba River, near Marion, McDowell County, North Carolina. A few years later, in 1886 (two years before Gray died), Charles S. Sargent, founding director of the Arnold Arboretum, found *Shortia* in some quantity in the Carolina mountain region at the headwaters of the Keowee River, the great eastern fork of the Savannah. Curiously, Sargent was looking for another then-lost species, *Magnolia cordata!* (*Magnolia cordata* was finally found again in 1913).

F. McG.

PLANTS OF THE DEEP SOUTH* —NATIVE AND EXOTIC

Julia F. Morton

BOTANISTS and horticulturists in the North and abroad were awakened to the beauty and diversity in the native vegetation of the southeastern United States largely through William Bartram's vivid account of his travels through North and South Carolina, Georgia and Florida in the 1780's. It is not difficult to determine the species which impressed him most, for one encounters in his chronicle repeated references to the "glorious magnolia" (*Magnolia grandiflora*) and the "majestic live oaks" (*Quercus virginiana*) . . . "some of astonishing magnitude."

These two trees, needing no improvement and readily brought into cultivation, graced the first lawns and parks of the Deep South. Preserved in natural settings, they have provided the enduring framework of famous gardens from Charleston to Brownsville.

Equally revered but less a symbol of the South is the elegant American holly (*Ilex opaca*), which has gradually migrated northward. It has benefited greatly by horticultural attention and among its more than 100 named varieties are some which thrive even in Minnesota and New Hampshire.

Roche

This is the "glorious magnolia" of the South, which Bartram mentioned often in his writings. It is the widely known southern species, *Magnolia grandiflora*.

Among classic charms of southern woodlands, the late-winter radiance and fragrance of the Carolina yellow jessamine (*Gelsemium sempervirens*) have inspired many an exclamation of delight. This glossy vine has long been cultivated within its natural range (mid-Florida to Texas and Virginia) and far afield, having been introduced into England in 1840. Less domesticated but noted for their spectacular spring displays in the wild are the white dogwood (*Cornus florida*), the graceful fringe-tree (*Chionanthus virginica*), the rampant trumpet-creeper (*Campsis radicans*), the cross-vine (*Bignonia capreolata*), the Florida flame azalea (*Rhododendron austrinum*) and the sweet-scented "swamp honeysuckles" (*R. viscosum* and *R. serrulatum*).

* The late Dr. H. Harold Hume defined the Lower South as embracing the eastern parts of South Carolina, Georgia, the southern regions of Alabama, Mississippi, and Louisiana, eastern Texas and all of Florida. To this one should add the 60-mile chain of Florida Keys terminating in Key West.

Natives and Orientals

As in most regions, the native plants under cultivation were soon outnumbered by foreign species as southern gardening developed, and the exotic now predominate in the outstanding floral attractions for which the Deep South is famed. Most are of Oriental origin, for the Far East and India have given us more decorative plants of all kinds than has any other area.

Lafayette, Louisiana, is acclaimed "Azalea City" for its vistas of evergreen azaleas, mainly derived from *Rhododendron indicum,* indigenous to Japan. Avery Island Jungle Gardens, some 30 miles away, boasts 30,000 azaleas, and its collection of camellias numbers 10,000 or more. *Camellia japonica* was taken from China to Europe in 1739 and a red variety was brought to a New Jersey greenhouse in 1798, a white variety in 1800. By 1825, camellias were the most popular garden blooms of the Lower South (as far as Central Florida). *C. sasanqua* arrived much later from Japan and *C. reticulata* from Yunnan and Kunming, China.

American wisteria (*Wisteria frutescens*), wild and occasionally planted along the Coastal Plain from Florida to Alabama, was shared with England as far back as 1724, but the trellissed pride of the Deep South is the Chinese species (*W. sinensis*), which reached us via England after 1825.

Long before the Civil War, the Cherokee rose (*Rosa laevigata*) from China, Formosa and Japan, was naturalized in Mississippi and adjacent states and it became the state flower of Georgia. The gardenia (*Gardenia jasminoides*), from China, was named by Linnaeus for Dr. Alexander Garden of Charleston and was grown in abundance in southern Alabama prior to 1860. It has remained a favorite throughout the acid soils of the Gulf region and the Southeast, though in the limestone of lower Florida it must be grafted onto the African species (*G. thunbergia*). Confederate-jasmine (*Trachelospermum jasminoides*), also from the Far East (China and Japan), was adopted into southern gardens in colonial days.

Two Asiatic trees that are characteristic of much of the Lower South and thoroughly naturalized are the crapemyrtle (*Lagerstroemia indica*) and the

The live oak *(Quercus virginiana),* generally festooned with "Spanish moss," was frequently noted as a "majestic" tree in the Bartram chronicle.

Genereux

Roche

Roche

Male flowers of holly (*Ilex opaca*), noticed by few people, are shown at left. The berries, at right, develop from the female flowers. The plant was first observed by a Huguenot party on the St. John's River in Florida in 1564, but it is not recorded in cultivation until 1744. The first botanical description of this American species was written by John Clayton in *Flora Virginica* in 1762.

chinaberry (*Melia azedarach*), both introduced by André Michaux into his South Carolina botanic garden between 1787 and 1801. Michaux played a major role in bringing foreign plants to the South and sending American species to Europe. In 1833 Joel Poinsett brought the poinsettia (*Euphorbia pulcherrima*) to Charleston from Mexico. Bougainvilleas (*B. glabra* and *B. spectabilis*) from Brazil were flourishing in Santa Barbara, California, before 1895 and were doubtless known in southern gardens at that time.

Oleander has Flourished

From Savannah to subtropical Texas and Key West, the Mediterranean oleander (*Nerium oleander*) has flourished for generations. Galveston is hailed as the "Oleander City of the World." Later distributed throughout the Deep South were the tropical American coral-vine (*Antigonon leptopus*), the Asiatic goldenrain-tree (*Koelreuteria formosana*), the Jerusalem-thorn (*Parkinsonia aculeata*), perhaps tropical American, and Arabian jasmine (*Jasminum sambac*) from India. Mr. and Mrs. Morris W. Clint of Brownsville have brought many types of cycads back from journeys into Mexico and such hobby collecting is contributing to diversification in the Gulf States.

But the results of past and continuing plant introduction presents the most bewildering array of species from Central Florida southward. From here down, the flame-vine (*Pyrostegia ignea*) from Brazil is resplendent in late winter on roofs, walls and trees. At the lavish Cypress Gardens near Winter Haven, the rich purple flowers of the Brazilian glory-bush (*Tibouchina arvilleana*) provide a summer spectacle amid a great variety of showy shrubs and vines.

The larger ornamental plant nurseries in South Florida stock more than 1,500 species, entirely apart from special collections of orchids, bromeliads or foliage plants. Nurserymen from the North are

appalled. On traveling to other parts of the United States, I am struck by the simplicity and order of northern landscaping in contrast to the plant profusion and rampant growth in this deepest part of the Deep South.

The plant consciousness and fervor that demands access to such a great assortment of gardening material (and particularly fast-growing plants) in this relatively new region of horticultural development springs from the missionary work done by Charles Torrey Simpson and a handful of other great and beloved plantsmen of the recent past. Pliny Reasoner established the Royal Palm Nursery (later Reasoner's Nursery) in Oneco in 1881 and brought in rare plants from many warm areas of the world. George Taber, in the same year, formed the nucleus of the fabulous Glen St. Mary Nursery near Jacksonville. Active with Taber in the breeding of azaleas, camellias and hollies was H. Harold Hume, who was also an authority on citrus culture, as well as botanist and, for some years, Dean of the College of Agriculture at the University of Florida.

Fancy-Leaved Caladiums

Dr. Henry Nehrling brought his plant enthusiasm to Gotha, Florida, in 1902. He continued to hybridize amaryllis, developed 1,500 named varieties of fancy-leaved caladiums, surrounded himself with 3,000 species of tropical and subtropical plants, including orchids, bromeliads, bamboos, palms and 100 species of *Ficus*. In 1919, he moved to Naples where the site and many of the specimens of his "Tropical Garden" are preserved as the Caribbean Gardens, thanks to Julius Fleischmann.

A contemporary of Nehrling's in Florida was Theodore L. Mead, who settled at Oviedo, where he too grew amaryllis in quantity. His notable work with bulbs and orchids, palms and other plants is commemorated in the Mead Botanical Garden at Winter Park, Florida. Their era overlapped with that of Dr. David Fairchild, the celebrated plant explorer, who retired to Miami and whose great zeal and charming writings popularized many foreign plants which he brought into our area. Named in his honor is the Fairchild Tropical Garden, established in 1938, which, among its many specimens, boasts more than 300 species of palms and has an extensive collection of cycads.

Florida's exotic plant population has been enriched by the plant distribution of the United States Plant Introduction Sta-

Flowering dogwood *(Cornus florida)* has proved to be one of the most adaptable of all ornamental trees in cultivation, and its abundant flowers make an ever-pleasing pattern. Its structure, foliage and fruits are also landscape assets, as they have been since the early 18th century. The first published account of the species appeared in Leonard Plukenet's *Phytographia* in 1691. It was based on information from John Banister, an English missionary in Virginia.

Roche

Genereux

The fringe-tree *(Chionanthus virginicus)*, one of the spectacular sights of southern woodlands in spring, has been an ornament to gardens as far north as New England for more than two centuries. It apparently reached the northern states from the South by way of England. The first authentic illustration appeared in Mark Catesby's *Natural History of Carolina* in 1771.

tion since its origin in Miami in 1898. Individuals who have specialized and contributed to widespread interest in particular fields include Mulford Foster, bromeliad expert in Orlando, and Edwin A. Menninger, "The Flowering Tree Man," of Stuart, Florida.

Among native species, Florida's state tree, the cabbage palm (*Sabal palmetto*) is being more and more employed in landscaping. South Florida's reigning palm is the incomparable royal (*Roystonea elata*). A shade tree second only to the live oak is the mahogany (*Swietenia mahagoni*). Ever-growing in decorative status are the seagrape (*Coccoloba uvifera*), the silver buttonwood (*Conocarpus erectus*), and the coco-plum (*Chrysobalanus icaco*).

Conspicuous Flowering Trees

The indigenous, orange-flowered geiger-tree (*Cordia sebestena*), not yet fully appreciated, was named by Audubon after John Geiger, a pilot and Key West "wrecker" of the 1830's. The most conspicuous and common flowering trees are the royal poinciana (*Delonix regia*) from Madagascar, the golden shower (*Cassia fistula*) from India, jacaranda (*J. acutifolia*) from Brazil, the red silk-cotton (*Bombax malabaricum*) from the East Indies and Australia, the bottle-brushes (*Callistemon citrinus* and *C. speciosus*) from Australia, and the Asiatic orchid trees—*Bauhinia variegata*, which is spring-blooming, *B. purpurea*, fall-blooming, and, of more recent introduction, *B. blakeana* from Hong Kong, which is winter-blooming and has the advantage of not producing a multitude of seed-pods. The African-tulip-tree (*Spathodea campanulata*) has been reduced in numbers by windstorms. The pink trumpet-trees (*Tabebuia pallida* and *T. palmeri*) are replacing the older *T. pentaphylla*. All three are tropical American. Queensland umbrella-trees (*Schefflera actinophylla*) are popular not only in outdoor

Genereux

The trumpet-vine (*Campsis radicans*) is believed to have been planted in gardens as long ago as 1640. It attracted the early attention of plant hunters in the South.

landscaping but also as pot plants. Thousands of seedlings are raised for shipment north.

As street trees, the woman's-tongue (*Albizzia lebbek*) from Asia and the guaymochil (*Pithecellobium dulce*) from Mexico, widely planted in early days because they could withstand adversity, have been gradually eliminated by hurricanes and land development and succeeded by the Benjamin fig (*Ficus benjamina*) from India and Malaya and the black-olive (*Bucida buceras*) native to the West Indies and Central America.

The excessively tall Mexican Washington palm (*Washingtonia robusta*), ill-suited to the hurricane belt, is being abandoned in favor of the South American queen palm (*Arecastrum romanzoffianum*) in street beautification. Great numbers of the Manila palm (*Veitchia merrillii*) from the Philippines are appearing in private and public plantings. For popular appeal, it is being sold as a "miniature royal." The common coconut palm (*Cocos nucifera*), which suffers much cold injury north of Palm Beach, succumbs to lethal yellowing in Key West

Genereux

Joel Poinsett, for whom the poinsettia (*Euphorbia pulcherrima*) was named, brought the first plants into his Charleston, South Carolina, garden from Mexico in 1833.

Genereux

The gardenia (*Gardenia jasminoides*) was introduced into the southern United States from China (probably by way of England) some time before the middle of the 19th century. Its fragrant, waxy, white flowers are borne among glossy evergreen leaves.

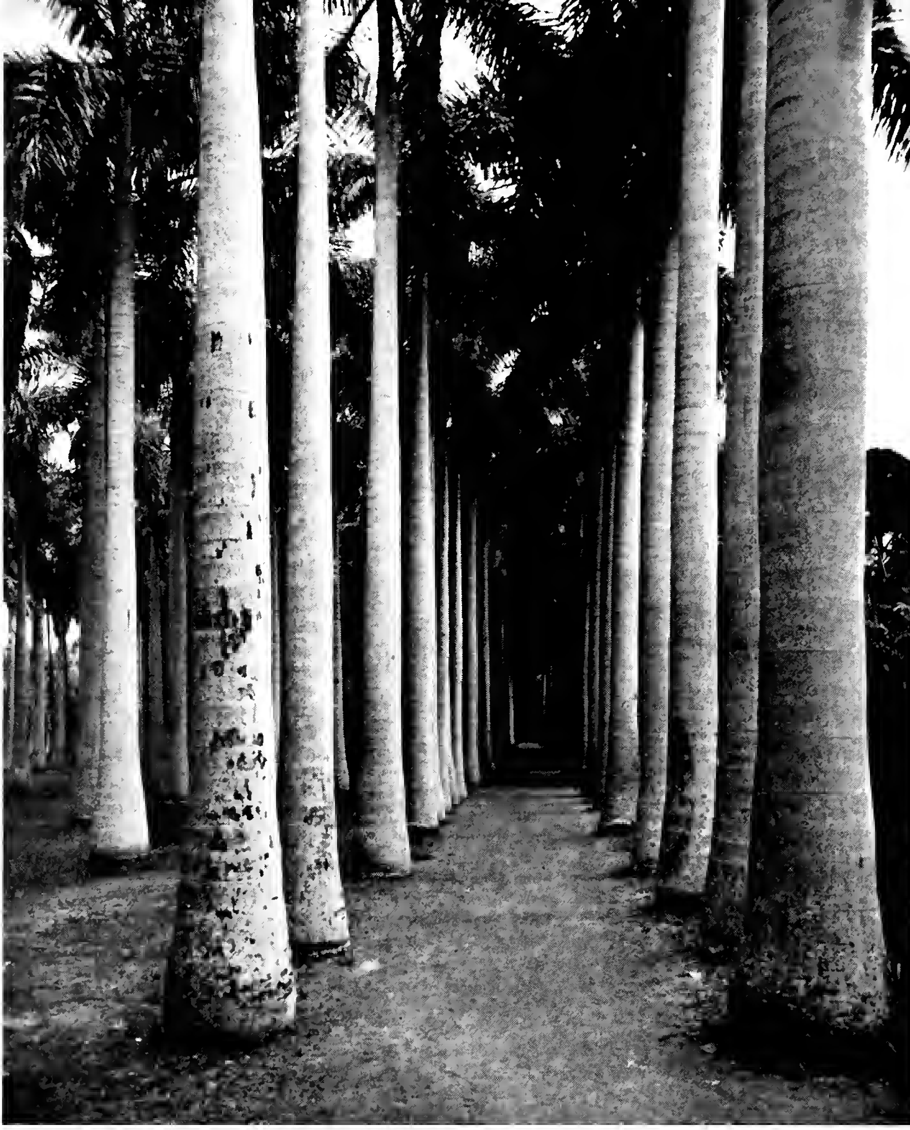
and is being replaced there by the Malay golden variety, which is resistant to this disease.

Prominent on the South Florida scene for many years have been two trees from "Down Under," the Australian-pine (*Casuarina equisetifolia*) and the cajeput (*Melaleuca quinquenervia*), both of which have become naturalized where no native trees will flourish.

Showy Shrubs

Gayest of shrubs are the colorful leaf-crotons (*Codiaeum variegatum*) from Malaya, in limitless variety, and the ever-popular red ixora (*Ixora coccinea*) of southern Asia, which blooms so profusely and vividly when close-clipped as a hedge.

The rangy Chinese hibiscus (*Hibiscus rosa-sinensis*) which reached Florida in the 1880's, is now less used for hedges, since it requires much control, but the magnificent hybrids have gained much attention as specimen shrubs since 1945. Old-timers grew the thorny, South African carissa (*Carissa grandiflora*) for its edible red fruits and fragrant white flowers, both borne the year around. Today very compact dwarf forms are prized for borders and bedding.



Genereux

Of all the palms that are cultivated in the Deep South, none quite equals the native royal palm of southern Florida *(Roystonea elata)* in majesty of growth. In the wild the largest stand remains in Big Cypress Swamp.

Near-tropical Vines

The most frequently seen vines in South Florida are the yellow allamanda (*A. cathartica*) from Brazil, the chalice-vine (*Solandra longiflora*), native to the West Indies, the blue-flowered sky-vine (*Thunbergia grandiflora*) from Bengal, and the queen's wreath (*Petrea volubilis*) introduced from the West Indies and northern South America.

Such luxurious foliage plants as the ceriman (*Monstera deliciosa*) from Central America and self-heading philodendrons, especially *P. selloum,* from Brazil, and other aroids, flourishing in the open, are important features distinguishing this area as near-tropical. A truly tropical climate can be claimed only for Key West where the Polynesian breadfruit (*Artocarpus altilis*) is safe from frost. ♦

ELUSIVE FRANKLINIA

FROM time to time newspapermen give undue credence to a report that *Franklinia alatamaha* was found again in the wild in 1929 by Mr. G. A. Schultze, a government forester. Over the years the story has been confused in various ways.

To be clear on the facts and to guard against future confusion about *Franklinia,* we questioned Edgar T. Wherry, Professor Emeritus of Botany at the University of Pennsylvania. He very likely knows more about the purported rediscovery than any other man now living. Dr. Wherry writes: "In 1929 Dr. Frederick V. Coville, Chief Botanist of the Department of Agriculture, showed me a *Franklinia* shoot sent him by Mr. Schultze. The leaves bore an unusual pubescence which Coville had seen only on a clone in a southern nursery, where Schultze had been known to have collected material. I was sent down to investigate, my fourth trip in search of *Franklinia.*

"Mr. Schultze told me that he had been on a trip in a remote swamp, and placed a number of specimens in a vasculum. When the vasculum was unloaded, one of them turned out to be *Franklinia.* At first he could not recall its exact source, but then in a *dream* visualized the spot. [A search of the spot disclosed no *Franklinia.*—Ed.]

Roche

Franklinia flowers, which can be seen today only under cultivation.

"When a service club asked him to tell about his forestry research work, he said he had rediscovered the long lost *Franklinia.* This claim naturally found its way into newspapers, and is resurrected in horticultural literature from time to time." Thus, unfortunately, the *dream* came into the record as a fact. It clearly was not a fact then, and it is not now.

The Franklinia Record

1—Discovered by John Bartram in 1765. See Helen Gere Cruickshank (ed.), *John and William Bartram's America: Selections from the Writings of the American Naturalists* (Garden City: Doubleday & Company, Inc., 1961), pp. 83-86.
2—Relocated by William Bartram in 1773. See Francis Harper, *Travels of William Bartram* (New Haven: Yale University Press, 1958), p. 337.
3—Seen again by Moses Marshall in 1790. See William Darlington (ed.), *Memorials of John Bartram and Humphry Marshall* (Philadelphia: Lindsay & Blakiston, 1849), p. 563.
4—Last seen in the wild by John Lyon in 1803. See Joseph and Nesta Ewan, "John Lyon, Nurseryman and Plant Hunter, and his Journal, 1799-1814", in *American Philosophical Society Transactions,* Vol. 53, Part 2 (1963), pp. 22-23.

TREES POPULAR IN 19TH CENTURY

Criteria were different 100 years ago

Frederick McGourty, Jr.

TREE tastes have been shaped in part by conditions of the times. An important factor has been the change in the size of properties. The 19th century homeowner, with a large property, planted large trees. Today's homeowner, faced with a smaller property, plants smaller specimens.

Also, the average homeowner 100 years ago had no great interest in ornamental horticulture, and even less in landscaping. His foremost interest was in the fruit tree. Old catalogues listed countless apple and pear varieties, now largely forgotten, and ornamental trees were often relegated to back pages.

Fruit trees for home landscapes are still popular, in part because of dwarfing understocks which make them more adaptable to today's small home lots. They particularly attract the new gardener who is innocent of the amount of care they require to produce superior fruit.

Although the common fruit trees are attractive in flower, the 19th century homeowner grew them primarily for their fruit. For strictly flowering trees he seems to have had definite criteria. They had to be fast growing and eventually fairly large to serve also as shade trees, and they had to be easy to propagate. Yesterday's homeowner obtained seedling plants from a neighbor more often than he does today.

The most popular flowering trees of the 19th century were the common horse-chestnut (*Aesculus hippocastanum*), southern catalpa (*Catalpa bignonioides*), empress-tree (*Paulownia tomentosa*) and tree-of-heaven (*Ailanthus altissima*). All have declined in popularity today. Though spectacular in bloom, their leaf texture was coarse, tree habit was often mediocre, and winter character was austere. The empress-tree and tree-of-heaven, considered among the finest trees in the early 1800's, became weed trees in the latter part of the century. The empress-tree is now a common sight along roadsides south of New York City. An idea of its former majesty may be gained by a visit in early May to Longwood Gardens in Kennett Square, Pennsylvania, where there is still a splendid allée of these once popular trees.

The tree-of-heaven, even more widely naturalized, is particularly associated with large cities. With the possible exception of the London plane (*Platanus acerifolia*)—which, as a hybrid, has not spread from cultivation—no tree can tolerate city conditions better than the tree-of-heaven. It is the tree referred to in Betty Smith's novel, "A Tree Grows in Brooklyn" (1947). Its ability to grow well on wretched soil is perhaps unmatched by any other hardy tree.

Today, one often sees mature horse-chestnut trees, but young ones are increasingly hard to find in nurseries. The eventual height (up to 100 feet) makes them unsatisfactory for most home lots today. Moreover, the dense shade they cast prevents grass from growing beneath them. Warm, dry summers may bring about an unsightly leaf scorch. Like almost all fast-growing trees, the horse-chestnut has brittle wood that is subject to storm damage. Finally, the inedible nuts can be a nuisance on lawns. The double-flowering horse-chestnut (*Aesculus hippocastanum baumannii*), which does not produce nuts, is found in the nursery trade more often today than the common horse-chestnut.

Mature specimens of the southern catalpa are still common, but this native tree is not planted nearly as widely as in

Arnold Arboretum

Norway spruce (*Picea abies*) was one of the favorite conifers in the 19th century. It proved, however, to occupy too much space, to grow too tall, and to be unattractive at maturity with heavy, drooping, lower branches and sparsely needled upper ones.

former years. The large leaf has a coarse appearance. The long bean-like pods, which often last well into winter, are unsightly, and the tree habit is unusually formal. The umbrella catalpa (*Catalpa bignonioides nana*), a nonflowering dwarf form once frequently grafted as a standard in front of Victorian houses, is even more formal; it has almost disappeared from the nursery trade.

One of the most popular conifers of the 19th century was the Norway spruce (*Picea abies*), a tree that may eventually attain 150 feet in height. Young specimens are dense, fast growing, and attractive. Old specimens are generally open in habit, graceless, and somber. The pendulous lower branchlets on older trees, most noticeable in winter when other trees are bare, may in fact give a lugubrious character to the tree. Nineteenth century gardeners seldom gave the Norway spruce adequate planting space. While young trees are less common now, gardeners are still prone to commit the same error.

"Weepers"—trees with a pendulous habit—were also highly esteemed in much of the 19th century. The familiar weeping or Babylonian willow (*Salix babylonica*) is still widely planted from New York City southward, but it was also once extensively planted farther north, where the tree was *not* dependably hardy. Its popularity in 19th century America was in part dependent on the tree's association with Napoleon. In exile on the island of St. Helena, Napoleon frequently meditated—or brooded—under a Babylonian willow. In 1829 rooted cuttings of this very tree were offered by Prince's Nursery for $1.00 a plant. Rooted cuttings from other Babylonian willows then sold for 25 to 50 cents a plant. Today, in colder parts of the United States, the Babylonian willow has been superseded by the weeping white willow (*Salix alba tristis*). Both trees, fast-growing and weak-wooded, are easily propagated by cuttings. They are fairly short-lived.

Other "weepers" widely planted in the 19th century were the Kilmarnock willow (*Salix caprea pendula*) and, toward the end of the century, the Camperdown elm (*Ulmus glabra camperdownii*) and Tea's mulberry (*Morus alba pendula*). While available, none are common in the nursery trade today. ◆

Brooklyn Botanic Garden

Although the flowers of catalpa make the tree seasonably attractive, its long pods litter the ground in autumn. Seedlings occur frequently, often to the point of making catalpa a weed tree.

PLANT EXPLORATION IN THE WEST

Elizabeth McClintock

IN less than a century, 89 years to be exact, from the year 1790 until the close of the period of the Great Surveys, in 1879, the trans-Mississippi West changed from an unknown and unmapped wilderness belonging to England, France, Spain and later Mexico, to a settled part of the United States. During these years, and certainly early in this period, when the country was an unsettled and dangerous wilderness, plant collections for both botanical and horticultural purposes were made in association with exploring expeditions, pioneer settlements, early commerce such as fur trading, and military movements.

Four early expeditions or voyages of discovery from Europe, usually referred to by the names of their commanders, LaPérouse, Malaspina, Vancouver, and Kotzebue, set the stage for later individual collectors sent out for the purpose of bringing back to Europe some of the then-new and unusual plants from the Pacific Coast of North America. The individual collectors including Douglas, Coulter, Hartweg, Jeffrey, and Lobb first brought to Europe many western American plants which are still grown there.

The period of their activities, the second quarter of the 19th century, has been called the Golden Age of Horticultural Exploration in the American West. During this period European botanists including William Jackson Hooker of the University of Glasgow and later the first director of the Royal Botanical Gardens at Kew, and Augustin Pyrame DeCandolle, director of the herbarium and botanical garden in Geneva, worked on the scientific collections brought from western North America to Europe by these early collectors.

In August 1785 the French navy sent out a well-equipped expedition under the command of Jean François de Galaup LaPérouse to circumnavigate the globe. In mid-September of 1786 the expedition visited the Spanish mission settlement at Monterey, California. Here was made a collection of a few plants and seeds. From this seed a plant was grown at the Jardin des Plantes in Paris which the French botanist, Lamarck, named *Abronia umbellata*. This was the first plant from California to be grown in the Old World and also the first one from western North America to be described and named.

A Spanish voyage of discovery under the command of Alexandro Malaspina left Spain in July 1789. Among the staff of this expedition were two botanists, Luis Née and Thaddeus Haenke. While on the California coast at Monterey, Haenke made a collection of plants which included *Berberis pinnata*. These collections were the earliest made in California and gave Haenke the honor of being the first botanist to visit this state. Luis Née, who stayed in Mexico and did not visit California, published in a scientific journal in Madrid in 1801 the first descriptions of two oaks from California, *Quercus agrifolia*, the California live oak, and *Q. lobata*, the California valley oak.

Archibald Menzies was the naturalist who accompanied Captain George Vancouver on the *Discovery*. Menzies was given careful instructions by Sir Joseph Banks for the investigation of the natural history of all countries visited. He collected about 300 species on the Pacific Coast and was the first to find many trees such as the coast redwood (*Sequoia sempervirens*), the California-laurel or Oregon-myrtle (*Umbellularia californica*), the grand fir (*Abies grandis*), the big-leaf maple (*Acer macrophyllum*), the madrone (*Arbutus menziesii*), the Nootka cypress (*Cupressus nootkatensis*), the wax-myrtle (*Myrica californica*), the

Genereux
Blue spruce was discovered in the West by Charles C. Parry about 1850.

Genereux
Douglas-fir was one of many discoveries of Archibald Menzies in the 1790's.

Sitka spruce (*Picea sitchensis*), the Douglas-fir (*Pseudotsuga menziesii*), and California-holly or toyon (*Heteromeles arbutifolia*).

A Russian Expedition

Early in the 19th century the Russians sent out a well-equipped expedition which visited the Pacific Coast. Under the command of a young lieutenant in the Russian navy, Otto von Kotzebue, the vessel called the *Rurik* sailed in 1815 on a voyage of discovery which lasted three years. Among the scientific staff was the naturalist, Adelbert von Chamisso (1781-1838), and the surgeon, Johann Friedrich Eschscholtz (1793-1831). In California, particularly around San Francisco, they collected many plants for the first time and of all of the important discoveries and contributions resulting from this expedition none was more important than those in botany. They found the California poppy which Chamisso named *Eschscholzia californica* in honor of his friend on the voyage. In addition to this poppy Chamisso named more than thirty new species collected in San Francisco.

David Douglas (1799-1834), a native of Scotland, was the first of several collectors sent out from England to the Pacific Coast. Douglas was trained as a gardener and it was at the Botanical Garden in Glasgow that he came under the influence of Dr. William Jackson Hooker, then of the University of Glasgow. Hooker recommended to Joseph Sabine, honorary secretary of the Horticultural Society of London (which in 1866 became the Royal Horticultural Society), that Douglas be sent by the society to

California Academy of Sciences

The California poppy (*Eschscholzia californica*) still covers vast areas with vivid yellow bloom, just as it did about 1815, when discovered on a Russian expedition by the surgeon, Johann Friedrich Eschscholtz.

North America. Douglas was instructed to collect living plant material to be used in the gardens of the British Isles and dried specimens to be used by botanists, particularly Hooker, who was working on a flora of North America.

Douglas' accomplishments were so great that he overshadowed those who followed him. Among the many plants which he collected, some of which he introduced to English gardens, are several firs (*Abies grandis, A. lasiocarpa, A. procera, A. amabilis*), the vine maple (*Acer circinatum*), one of the serviceberries (*Amelanchier alnifolia*), the Douglas-fir (*Pseudotsuga menziesii*), the madrone (*Arbutus menziesii*), and a shrub which the natives called salal (*Gaultheria shallon*), and two trees which had been earlier discovered by Menzies, the Sitka spruce (*Picea sitchensis*) and the California wax-myrtle (*Myrica californica*).

Dr. Thomas Coulter (1793-1843), a native of Ireland, was one of the important early botanical explorers in North America, particularly in California and Mexico. In November 1831 he arrived in Monterey where he met Douglas. The two botanists explored and collected together during the following winter and spring. Among Coulter's many discoveries, some of which were named for him, are the Coulter pine (*Pinus coulteri*) which is remarkable for its large heavy cones, and the Matilija poppy (*Romneya coulteri*), a handsome large white-flowered poppy occasionally seen in gardens.

Zauschneria and Castanea

The Horticultural Society in London which had sponsored Douglas sent Karl Theodore Hartweg (1812-1871) first to Mexico and then to California. The society specifically requested Hartweg to look for the "beautiful Zauschneria and the evergreen Castanea." The latter probably refers to the giant chinquapin (*Castanopsis chrysophylla*) discovered in 1831 by Douglas. He found both of these as well as the Monterey cypress (*Cupressus macrocarpa*), the canyon oak (*Quercus chrysolepis*), the knob-cone pine (*Pinus attenuata,* synonym: *P. tuberculata*), and the black oak or Kellogg oak (*Quercus kelloggii*).

However, Hartweg's introductions were probably of less importance than his collections of dried botanical specimens which, at least those from California, were worked on and published by George Bentham, one of the leading English botanists of the day.

The widespread interest in the plant introductions of Douglas to the British Isles led to the formation in 1850 of an organization in Scotland known as the Oregon Botanical Association or simply as the Oregon Expedition, which engaged John Jeffrey (1826-1854) to go to western North America for three years to bring back seeds to be divided among the subscribers. He spent from 1851 to 1854 in Washington, Oregon, and California. He was not as successful as his sponor had hoped. However, he managed to collect over 400 species of plants.

During the 19th century and the early part of the 20th the leading British nursery firm was that of Messrs. Veitch of Exeter and Chelsea. It was notable for its many introductions from America and Asia which became well known garden plants, and for having trained many fine

gardeners. The firm of Veitch sent William Lobb (1809-1863) to North America as one of their collectors. From 1849 to 1853 he was on the Pacific Coast where he explored and collected in California and Oregon. He arrived in San Francisco in the summer of 1849, a year and a half after the discovery of gold in California, but he had not come for gold.

The introduction which gave Lobb his greatest fame was of the giant sequoia or the big-tree (*Sequoiadendron giganteum*, synonym: *Sequoia gigantea*). Lobb was not the discoverer of this tree but learned of it through Dr. Albert Kellogg at a meeting of the California Academy of Natural Sciences and, according to Sargent, "immediately started for the Sierra Nevada, where he secured specimens and two living trees, which he carried to England on the first steamer leaving San Francisco," thus heralding the discovery of one of the world's largest, oldest, and most famous trees.

Roche

The Oregon-grape (*Mahonia aquifolium*) was brought from the wild for the first time by the Lewis and Clark expedition. It was originally grown under cultivation by the Bernard M'Mahon nursery in Philadelphia.

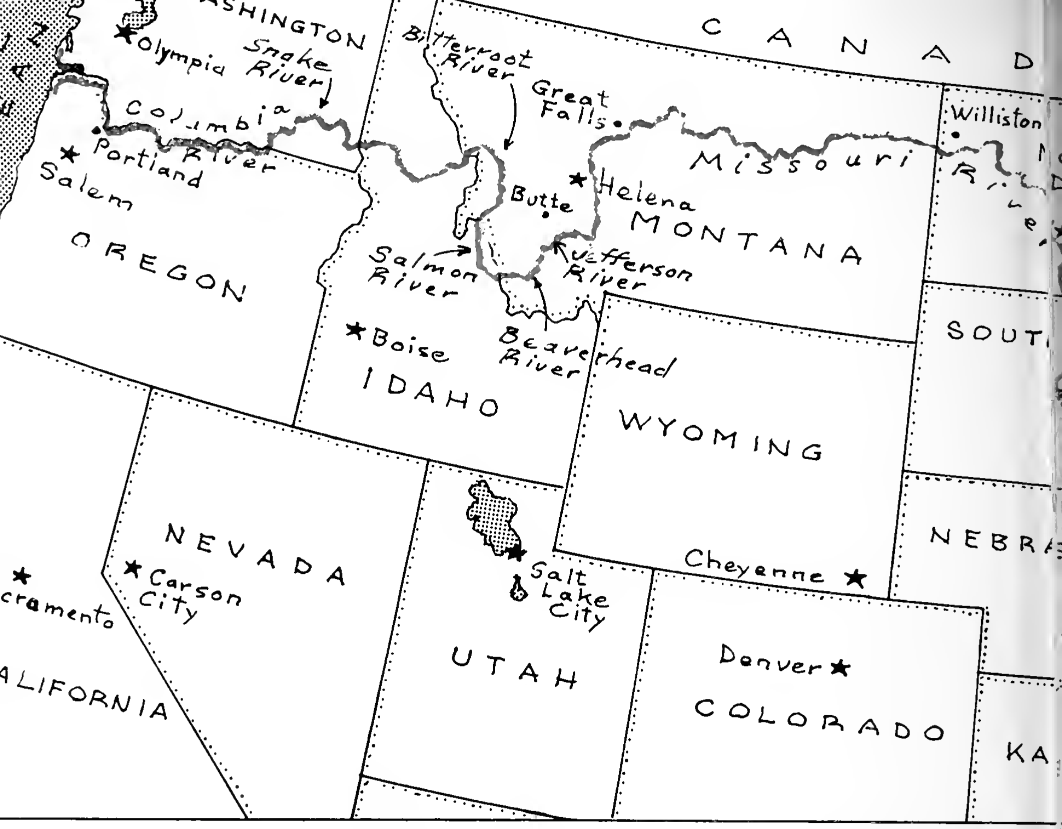
Lewis and Clark Expedition

The earliest expeditions to western North America were European in origin, their results were published in Europe and the specimens collected by their naturalists were deposited in European cities. It was not until after the Louisiana Purchase in 1803 that the first transcontinental expedition was sent out by the government of the United States. This expedition, initiated by President Thomas Jefferson in 1803 when he obtained from Congress the necessary funds, had as its primary objective the exploration of the Missouri River and related streams with a view toward "the most direct and practicable water communication across the continent for purposes of commerce." It was well equipped with 25 men under the two leaders, Meriwether Lewis and William Clark. Both leaders had previous military experience and were expert woodsmen but neither had had any scientific training.

Considering the vicissitudes of travel, the expedition made noteworthy contributions in many fields. They collected seeds and botanical specimens and today there are about 200 of their herbarium specimens in the Philadelphia Academy of Natural Sciences. Of these specimens many represented new species because, except for Oregon where Menzies had been earlier, they traveled through a vast region not previously explored scientifically. Although their collections represented only a few of the plants which they saw, their journals mention for the first time many of the plants later collected by others.

Plant Collections Studied

After the expedition the plant collections were sent to Philadelphia where they were studied by Frederick Pursh, who was preparing a flora of North America. Bernard M'Mahon, a nurseryman in Philadelphia, asked President Jefferson for seeds collected on the expedition. Jefferson generously gave M'Mahon



Henry B. Aul

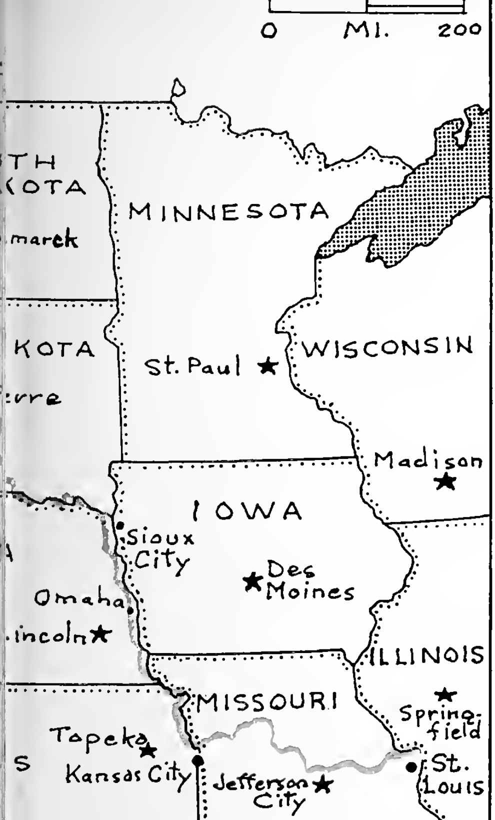
Route followed by Lewis and Clark on their famous western expedition of 1803-1806.

the whole of his own share and from these M'Mahon grew for the first time some garden plants now well known, such as the Oregon-grape (*Mahonia aquifolium*) and a snowberry, *Symphoricarpos rivularis,* which was introduced into England about 1817. The bitter-root, *Lewisia rediviva,* was grown by M'Mahon from a root removed from a dried herbarium specimen, which led Pursh to write of it: "This elegant plant would be a very desirable addition to the ornamental perennials, since, if once introduced, it would be easily kept and propagated. . ." Some plants named by Pursh which we know as ornamentals are: golden currant (*Ribes aureum*), salmon-berry (*Rubus spectabilis*), snow-on-the-mountain (*Euphorbia marginata*), vine maple (*Acer circinatum*), big-leaf maple (*Acer macrophyllum*).

Thomas Nuttall (1786-1859), born in Yorkshire, came from England to Philadelphia in 1808. There he studied botany under Benjamin Smith Barton and traveled along the east coast collecting and becoming acquainted with plants of the region. Nuttall lived in the United States for over 30 years during which he made three journeys to the West and collected plants extensively. His great contribution to botany, aside from his collections, was the publication of his *Genera of North American Plants.*

Rocky Mountain Expedition

Following the Lewis and Clark Expedition, it was nearly 20 years before another American overland expedition set out to explore the vast area west of the Mississippi River. Secretary of War J. C. Calhoun in 1819-1820 sent out the Rocky Mountain Expedition under Major Stephen H. Long (1784-1864) to deter-



mine the western boundaries of the Louisiana Purchase and the adjoining Spanish territory. Accompanying this expedition was the botanist Edwin James (1797-1861), the first one to collect in the central Rocky Mountains. He turned his collections over to John Torrey, who published an account of them. One of James' discoveries was the limber pine (*Pinus flexilis*).

Nearly 40 years after the Lewis and Clark Expedition the United States government sent a second expedition west to the Pacific Coast. By 1840 Americans were moving westward, beyond the Mississippi River, first to the Pacific Northwest and later to California, particularly after the discovery of gold in 1848. The routes to the West were unmapped and passed by word of mouth from those who had gone before, mostly courageous frontiersmen, trappers, and Indian guides.

In order to gain information about the West the government sent out three expeditions under John Charles Fremont (1813-1890) between 1842 and 1846. Fremont's career as an explorer began when he became a second lieutenant in the United States Topographical Corps and assisted with surveys made by the Corps in the eastern United States. This experience, which developed his zeal for exploration and his ability at map making, his meeting with Senator Thomas Hart Benton of Missouri who was an advocate of westward expansion, and his marriage to Benton's daughter, all contributed to his appointment as leader of the three expeditions.

The Sierra Nevada

Fremont was not a botanist by training but because of his interest in it he made collections some of which were later worked on by Torrey. In the Sierra Nevada of California he discovered two of California's choicest ornamental shrubs, *Fremontodendron californicum* (*Fremontia californica*), the flannel-bush, and *Carpenteria californica*, a relative of mock-orange, and two trees, the interior live oak (*Quercus wislizenii*) and the incense-cedar (*Libocedrus decurrens*). In addition he discovered two other trees, the single-needle pine (*Pinus monophylla*), near Cajon Pass in southern California (San Bernardino County), and the Fremont cottonwood (*Populus fremontii*), in the foothills along Cottonwood Creek in the northern Sacramento Valley (Tehama County).

During the decade of 1850 to 1860 the United States government sent many survey groups to the West. Among these were the United States and Mexican Boundary Surveys and the Pacific Railroad Surveys. Accompanying these surveys were geologists, geographers, zoologists, and botanists, who through reports of the various surveys made valuable, and often the first, contributions to the knowledge of the vast unknown territory which they had traveled through.

Charles Christopher Parry (1823-1890) served with the United States and Mexican Boundary Survey from 1849 to 1852

in that segment of the survey which was in the charge of Major William H. Emory (1811-1877). While with the survey Parry traveled between Texas and southern California, collecting plants and observing the vegetation. After 1852 he visited other parts of the West.

Alpine Vegetation

Because of his interest in the alpine vegetation of the central Rockies, Parry spent many summers in Colorado collecting plants found earlier by Edwin James. Among the many plants which he discovered were the Torrey pine (*Pinus torreyana*), the Parry pine (*Pinus quadrifolia*), the bristle-cone pine (*Pinus aristata*), California black walnut (*Juglans californica*), the blue spruce (*Picea pungens*), the Engelmann spruce (*Picea engelmannii*), the lemon lily (*Lilium parryi*), and the Enscnada buckeye (*Aesculus parryi*).

The Pacific Railroad Survey along the 35th Parallel from western Texas to southern California in 1853 and 1854 was in the charge of Lieutenant Amiel Weeks Whipple. John Milton Bigelow (1804-1878) accompanied this expedition as surgeon and botanist and probably collected most of the plants of the Survey. After the termination of the Survey in February 1854 near Los Angeles, Bigelow traveled on his own northward to San Francisco and east to the Sierra Nevada.

He wrote a botanical narrative of the route of Lieutenant Whipple's expedition and an account of the valuable and remarkable forest trees of California, both of which are published in the report of this survey. Three of his discoveries were *Clematis bigelovii, Aster bigelovii,* and the jumping cholla or teddy-bear cactus (*Opuntia bigelovii*).

George Thurber (1821-1890), through the influence of his friend John Torrey, was appointed in 1850 to the United States and Mexican Boundary Survey and served for nearly four years as botanist, quartermaster and commissary. Thurber as well as Bigelow was attached to the segment of the Survey traveling with John R. Bartlett, United States Commissioner of the Boundary Survey.

Thurber's plant collections, worked on by Asa Gray, included the New Mexican locust (*Robinia neomexicana*), the desert smoke-tree (*Dalea spinosa*), and the crucifixion-thorn (*Holocantha emoryi*).

Texas, New Mexico, Arizona

During the first half of the 19th century botanical activities were also going on in the southern part of the West—Texas, New Mexico, and Arizona. Jean Louis Berlandier (1805-1851) was sent by the Swiss botanist, DeCandolle, as a botanical collector to North America. During the years 1828 and '29 he collected in southeastern Texas. Among the plants mentioned in his writings are the widely distributed desert creosote-bush (*Larrea divaricata*), the cenicello, or Texas-sage (*Leucophyllum frutescens*), and the Texas black walnut (*Juglans microcarpa*).

To William Jackson Hooker goes the credit for sending out the next collector to reach Texas. Thomas Drummond (?1790-1835) spent less than two years there, arriving at Velasco, the mouth of the Brazos River, from New Orleans in March 1833 and remaining until the end of 1834. His arrival there coincided with a cholera epidemic and a disastrous flood on the Brazos. These two events greatly hampered his collecting activities, yet he managed to send about 750 species of plants to Hooker. *Phlox drummondii* was probably his best known discovery in Texas.

Charles Wright (1811-1885) spent 15 years in Texas from 1837 to 1852. In 1844 he began to correspond with Asa Gray at Harvard and to send Gray his collections. In 1851 and 1852 Wright joined one of the parties surveying the boundary between the United States and Mexico, collecting in Texas, New Mexico, and Arizona. His collections from this excursion were reported on in the *Botany of the Mexican Boundary Survey.*

Frederick Jakob Lindheimer (1801-1879) arrived in Texas a year before

California Academy of Sciences

Two of the many drawings of western plants published by Charles Sprague Sargent in "Silva of North America," in 1890-1902. *Left:* western dogwood *(Cornus nuttallii)*; *right:* flannel-bush *(Fremontodendron californicum)*.

Wright and resided there for the rest of his life. Before leaving Germany to come to America Lindheimer had become acquainted with George Engelmann, the German physician and botanist who settled in St. Louis. It was at Engelmann's recommendation that Lindheimer in 1843 began to collect plants for Asa Gray as a professional collector. He collected in sets which he sent to Gray for eventual distribution and sale to subscribers. Lindheimer's plants were worked on by Gray and Engelmann, and among the many new species are several which commemorate their discoverer, *Lindheimera texana, Gaura lindheimeri,* and *Monarda lindheimeri.*

The last of the government surveys, usually referred to as the Great Surveys, led by J. W. Powell, J. V. Hayden, Clarence King, and George M. Wheeler, completed their work in 1879. With this was ended an era of American exploration in the West which had begun with the departure of the Lewis and Clark Expedition into an unexplored wilderness. At the close of the Great Surveys the wilderness had been explored, mapped, and partially settled, the major geographical and geological features were known and most of the plants had been described and their distributions recorded.

Torrey, Gray, Engelmann

The history of botanical exploration in the West, which began with European explorers who took their collections home, was continued by Americans whose collections remained in the United States. During the middle years of the 19th century, the period of westward expansion when military and scientific surveys of the resources of the West were taking place, three American botanists worked on the collections made by these surveys as well as those of individual collectors who came west. The names of these three men have already appeared on these pages, John Torrey (1796-1873) of Columbia College in New York, Asa Gray (1810-1883) of Harvard University in Cambridge, and George Engelmann (1808-1884) of St. Louis.

For about a half century these three men dominated the American botanical scene. They kept in touch with those in the field, encouraged new collectors to go out, recommended botanists and naturalists to the leaders of surveys, corresponded and collaborated with each other, and published new genera and species of plants in numerous scientific journals and reports. Their work laid the foundation for the more detailed work on the botany of the West which was to come later. ◆

EARLY PLANT INTRODUCTIONS FROM CHINA AND JAPAN

Francis de Vos

THE first inkling of the botanical treasures to be found in China reached the western world in the accounts of Marco Polo's travels during the latter part of the 13th century. His report of finding roses as big as cabbages (tree peonies) and pears weighing ten pounds (Chinese quince) were greeted with skepticism but, undoubtedly, stirred the imagination of many. The Portuguese rediscovered China in the early 1500's and for a period of 80 years monopolized European trade with that country. During this period they introduced the sweet orange (*Citrus sinensis*) to Portugal.

Beginning in the mid-1500's, scholarly Jesuit missionaries provided vast amounts of information on the botanical resources of China. From their writings, Europeans learned about the Japanese persimmon (*Diospyros kaki*), a reed (bamboo) which had 600 domestic uses, and tea, a beverage made from the leaves of a shrub (*Camellia sinensis*). George Joseph Kamel, for whom the genus *Camellia* was named, was one of the early Jesuits who described many of the Chinese plants that were growing on Luzon in the Philippines. Although the Jesuits introduced few plants themselves, their writings stimulated others to do so.

This delicate, early-flowering "Korean" azalea *(Rhododendron mucronulatum)* was started on its world-wide horticultural career by Emil Bretschneider, a physician to the Russian legation in Peking in the late 19th century. It grows wild in China, Korea and Japan.

Roche

The Dutch made their appearance in the Far East waters late in the 1500's and established themselves in Java. They were repulsed in their attempt to obtain a foothold on the mainland of China, but occupied Formosa for about 38 years before being forced out by a Chinese pirate in 1662. They were more successful in their relationships with Japan, and by 1611 the Dutch East Indies Company had established a trade agreement with the Japanese. During the 1600's, according to some accounts, the Dutch introduced into Holland from Japan the tea plant (*Camellia sinensis*), the florist's chrysanthemum (*Chrysanthemum morifolium*), and *Rhododendron indicum*.

Persistent English

The intrigues of the Portuguese were successful in thwarting the first English attempts in 1637 to open trade with China. Persistence by the English won them a foothold by 1677. Between 1698 and 1709 James Cunningham, an English naturalist, prepared herbarium specimens of 600 species that he found growing on the island of Chusan in the East China Sea. Cunningham is credited with the discovery of the China-fir which Linnaeus named *Cunninghamia* in his honor. Among the plants he introduced to

Europe were *Hibiscus manihot* and *Rhus chinensis.*

Pierre D'Incarville, a Jesuit father, spent the years between 1740 and 1756 in the area around Peking. He was a student of the great French botanist Bernard de Jussieu, whose son Antoine established the genus *Incarvillea* in honor of Father D'Incarville. D'Incarville sent seeds of many plants to Paris, to Phillip Miller at the Chelsea Physick Garden in London, and by overland caravan to St. Petersburg, Russia. Among some of the plants he introduced were the tree-of-heaven (*Ailanthus altissima*), Chinese scholar-tree (*Sophora japonica*), oriental arborvitae (*Thuja orientalis*), *Cedrela sinensis,* and the China-aster (*Callistephus chinensis*).

Banks Introductions

Sir Joseph Banks, one of the founders of the Horticultural Society of London, was a wealthy man and keenly interested in plants. Among the Chinese plants that he introduced between 1780 and 1817 were the following:

hydrangea	*Hydrangea macrophylla*
tree peony	*Paeonia suffruticosa*
magnolia	*Magnolia denudata*
banana-shrub	*Michelia fuscata*
glossy privet	*Ligustrum lucidum*
speciosum lily	*Lilium speciosum*
Chinese rose	*Rosa banksiae*

The fragrant Chinese rose was named in his honor.

Kaempfer and Others

From the time that the Dutch East Indies Company was established in Nagasaki in 1609 until 1859, only limited exploration was permitted by the Japanese and only under Dutch sponsorship. The German naturalist Engelbert Kaempfer lived in Japan from 1690 to 1692. Among the plants that he listed as growing there were *Camellia sinensis, Camellia japonica, Torreya nucifera,* and *Ficus pumila.* The Swedish naturalist C. P. Thunberg arrived in Japan in 1775 and spent a year preparing approximately 1,000 herbarium specimens of plants that he found in the area between Tokyo

Roche

Among the finest garden plants ever received in America from Japan was the gold-banded lily (*Lilium auratum*). It was one of Dr. George R. Hall's introductions in the 1860's.

and Nagasaki. The first major introductions to Europe did not occur, however, until the German medical officer with the Dutch East India Company, P. F. von Siebold, began sending plants to Europe between 1823 and 1829. He is credited with introducing these:

Siebold Introductions into Europe

flowering crab	*Malus floribunda*
Toringo crab	*Malus sieboldii*
kousa or Japanese dogwood	*Cornus kousa*
Chinese redbud	*Cercis chinensis*
hydrangea	*Hydrangea paniculata*
beauty-berry	*Callicarpa japonica*
spirea	*Spiraea thunbergii*
Japanese maple	*Acer palmatum*

The travels of Robert Fortune from 1843 to 1861 under the auspices of The Royal Horticultural Society, Chiswick, England, opened a new era in botanical exploration. The early explorations to China were largely confined to areas close

to the ports of Canton and Shanghai and to the area around Peking. From Fortune's explorations into the interior have come some of the most beautiful plants of our gardens. His favorite introduction was the floriferous and easy-to-grow shrub *Weigela florida*. It is interesting to note that this Japanese species of *Weigela* was a favorite garden plant in areas explored by Fortune.

Fortune Introductions into England

In 1860, Fortune made his fourth and final trip to the Far East. With Japan reopened to foreigners, he took the opportunity to explore the areas around Tokyo, Nagasaki, and Yokohama. Among his choicest introductions from China were:

Genereux

The tree peony *(Paeonia suffruticosa)* was introduced from China into England about 1800, and eventually into the United States by Sir Joseph Banks.

autumn-flowering anemone	*Anemone hupehensis japonica*
jasmine	*Jasminum nudiflorum*
fringe-tree	*Chionanthus retusus*
forsythia	*Forsythia suspensa fortunei*
Fortune's rhododendron	*Rhododendron fortunei*
Japanese umbrella-pine	*Sciadopitys verticillata*
osmanthus	*Osmanthus heterophyllus*
double-flowered deutzia	*Deutzia scabra plena*
Japanese primrose	*Primula japonica*

Concurrent with Fortune's last trip to the Far East were the explorations of Carl Maximowicz, a Russian botanist. He collected in remote areas in northern China, along the Amur and Ussuri Rivers. Among his discoveries are *Magnolia stellata*, an evergreen St. Johnwort (*Hypericum patulum*), a red-veined maple (*Acer rufinerve*), and the handsome blue-fruited glorybower (*Clerodendrum trichotomum*).

The variably marked, fragrant speciosum lily was brought from its Asiatic home by Sir Joseph Banks around the first quarter of the 19th century.

Genereux

First Plants to America

The first direct shipment of plants to

the United States from Japan was sent by Dr. George R. Hall in 1861. His introductions were sent to Parsons' Nursery in Flushing and to Francis Parkman in Boston. Some were planted and are still growing at his estate in Bristol, Rhode Island. *Malus halliana, Taxus cuspidata* 'Nana,' *Euonymus kiautschovicus,* and *Lilium auratum* were introduced by Dr. Hall.

In the closing years of the 1800's, botanical exploration in China continued unabated. Men such as Dr. Augustine Henry of England and Père Jean Pierre Armand David of France did not introduce many plants, but their herbarium collections were the lure that brought the great plant introducers to China in the early 1900's. Père Jean Marie Delavay was the most prodigious collector of all. Between 1867 and 1895, he prepared and sent to France 200,000 herbarium specimens, consisting of 4,000 species of which 1,500 were new.

Emil Bretschneider, a physician to the Russian Legation in Peking, is noted primarily for his definitive historical account of botanical exploration in China and for his introduction of the brillant-fruited Asiatic "bittersweet" vine (*Celastrus orbiculatus*), a pale rose-purple azalea (*Rhdodendron mucronulatum*), and a lilac (*Syringa villosa*).

Genereux

The star magnolia *(Magnolia stellata)* is a springtime gem in many gardens. First seen in China by Maximowicz about 1860, it was introduced in 1862 from Japan by George Rogers Hall.

The stately Japanese primrose *(Primula japonica)* comes from Robert Fortune's fourth and final trip to Japan in 1860.

Genereux

Prior to the early 1900's, the botanical treasures of China reached American gardens via the gardens of Europe. The early European settlers brought with them fruit trees and other useful plants. John Bartram of Philadelphia, and Robert Prince of Flushing, Long Island, introduced many ornamental plants in the 1700's. During the mid 1800's such famous nurseries as Ellwanger and Barry of Rochester, New York; Parsons' Nursery of Flushing; and the Meehan Nursery of Germantown near Philadelphia were selling Chinese plants introduced from Europe. By 1890, we had already received a number of plants directly from Japan. The stage was set for this country to receive directly, during the early 1900's, the Chinese and Japanese introductions of David Fairchild, Ernest Wilson, Frank Myer, and Joseph Rock. ◆

THE ARS—LONGWOOD PLANT EXPLORATIONS

John L. Creech

THE reader has by now recognized two facts—the continuity of the search for ornamentals and the importance of Asia to American horticulture. Many such plants collected by early explorers are still favorites in our gardens. This does not necesssarily reflect an unending expansion of their use, since the original collections may not meet the variable environments of our population centers. Yet the explorations made by more than 60 plantsmen over the last four centuries are fundamental to our present-day plant collecting efforts.

Although modern transportation has brought the sources of garden plants closer in time, political situations and prohibitive plant quarantines have all but stopped exploration by private institutions and individuals. This has placed a greater burden on public agencies at a time when beautification is receiving its greatest attention. As a result the Agricultural Research Service (ARS) of the U.S. Department of Agriculture has become the focal point of plant exploration activities for ornamental as well as economic plants.

Following the Second World War, the Department's facilities for plant introduction were oriented towards the procurement of crop breeding stocks to fill the gap in our germ plasm resources. Support could not be given to ornamental plant collecting.

These factors combined to encourage the development of a proposal by Longwood Gardens, Kennett Square, Pennsylvania, for an ARS-Longwood plant exploration program. In 1956, the U. S. Department of Agriculture and Longwood entered into an agreement to conduct plant explorations specifically for ornamental species. For the first time, public and private institutions were joining forces to meet the needs of the gardening public by introducing germ plasm to improve the quality and range of adaptation of our established ornamentals.

Plant Collecting Today

The basic concepts of collecting under the ARS-Longwood agreement are: to explore those regions of the world where exchange of plants and seeds cannot be effected; to collect breeding stocks from centers of origin of already important ornamentals; and to survey botanic gardens and foreign centers of ornamental horticulture for improved varieties that otherwise might not be made available.

The needs of plant breeders, nurserymen, botanic gardens and arboretums, city foresters, and conservationists are considered in carrying out this program. Proposed explorations are made known to these groups so that their interests will be included. When two or three alternatives have been determined, the final decision as to the location of the field exploration is made by the Chief, New Crops Research Branch, in consultation with the Director, Longwood Gardens. This is the only long-range program of ornamental plant exploration in the United States, or, for that matter, in any country.

Of the 11 explorations completed since 1956, 7 have been to temperate Asia. This reflects the important role that plants from there have played as street trees and landscape plants in the United States. Two trips were made to Europe (1957 and 1959) to assess progress made in the various ornamental centers in Great Britain and on the Continent, to bring to the United States cultivars needed to complete our collections.

One expedition was sent to Australia to fulfill the needs of southern California,

In Japan, wild evergreen azaleas and holly grow rampant on the volcanic slopes throughout the southernmost island of Kyushu. Scenes such as this have been described by explorers from Wilson's time in the early years of this century to the present day. The azaleas here are in full bloom.

since the environments are quite similar. The interests of tropical plant growers were met by an exploration to Brazil because many South American plants had made their way into Brazil's botanic gardens and experiment stations.

Eastern Asia is unquestionably the origin of the majority of plants grown in our gardens. Unfortunately, China, where many early explorations were made, is not accessible now. We have had to be content with exploring the bordering countries where plants have overlapping distribution or there has been exchange of plants with China for centuries. Our explorations in Asia have included Japan and the Ryukyu Islands, South Korea, Hong Kong, Northern India, Nepal, and the central Asian parts of the USSR.

Choice Japanese Natives

Since these expeditions have sought naturally distributed species and improved varieties, considerable effort has been made in Japan (1956, 1961) and South Korea (1966). The azaleas, camellias, lilies, and many of the broad-leaved evergreens so popular in our gardens are native to these countries. There has been a rapid increase in the use of these plants since the times when E. H. Wilson, David Fairchild, and other earlier explorers visited the Orient. Our knowledge of the genetic variability of these species is bet-

The author starting off on a day's march toward the lofty Himalayas. (In the winter of 1967, Dr. Creech undertook exploration in Taiwan.)

ter. We have a clearer understanding of the need for a broad plant sampling for breeding and testing for local adaptation. Through the ARS-Longwood program we have assembled the most complete germ plasm of the most important species native to Japan and Korea thus far. It could not have been done, however, had not early explorers paved the way.

First in Nepal, North India

The decision to explore Nepal (1962) and Northern India (1965) was based on the fact that no American collecting expedition had entered the Himalayas previously. Most of our existing plants from there were obtained second-hand from British sources. This region is the center of distribution of rhododendron species that are being crossed to produce hybrids for use in gardens. Furthermore, the plants of the Himalayas, in many instances, are similar to those of Japan, and Japanese botanists regard the Himalayas as the opposite end of a broad arc of common plant distribution. The plants collected on these expeditions thus contribute to our scientific knowledge of the world's flora as well as to horticultural collections.

Our experience of encountering *Prunus cerasoides* several times in Nepal illustrates the opportunities for increased horticultural research through plant exploration. This plant, a winter-flowering cherry, has been mentioned by every plant collector who has entered the Himalayas. Hooker (J. D.), in his report on the climate and vegetation, says: "The *Bucklandia* flowers in this month at 6000 to 7000 feet, a magnificent tree as regards form and foliage; *Wightia,* a scandent Bignoniaceous tree, also blossoms profusely, bearing no leaves and forming immense masses of red in the forest; *Pittosporum* blooms and a *Prunus*-like *Padus,* whose leaves are excellent fodder for cattle."

Prunus cerasoides Encountered

While we did not see the other plants mentioned in western Nepal, *Prunus cerasoides* was fairly common in the hills near Machhapuchhare, an isolated spur of the Annapurna Himal, towering 22,-958 feet over the town of Pokhara. Pokhara is the starting point of all expeditions to western Nepal. Everyone relies on the kindness of the small mission hospital located here as a last contact point before departure.

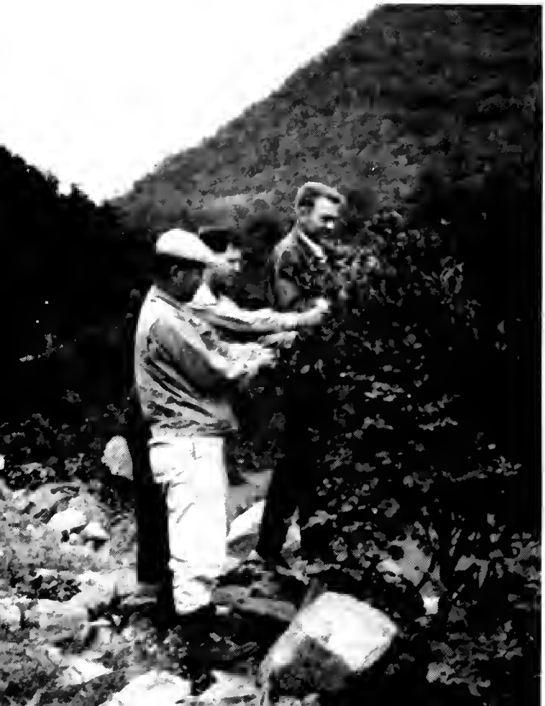
The temperate forest of the Himalayas between 6,000 and 11,000 feet is delightful during the rain-free period of autumn except that few plants are in flower. The seed crops are abundant and this suited our purposes perfectly. The days are warm and sunny with bright, clear, cool mornings. About 3 p.m. the fog rolls down from the perpetual snows and lifts again about 8 p.m.

Our first encounter with *P. cerasoides* at Machhapuchhare was as we reached 7,150 feet on a small ridge behind our camp. As we searched the vegetation down the faces of the ridge, a soft mixture of pink and bronze was our first awareness of *P. cerasoides*. It is a small tree with somewhat pendent branches, pink flowers, and bronzy new growth. The flowers and new leaves appear on short side shoots during November and December. But the terminal branch buds remain dormant until some time in the spring.

It should be noted that during the flowering period, there are light frosts every morning but the temperature does not go below 20°F. during the winter even at this elevation. The fruit matures in the spring. How this species will perform in our country is pure conjecture, but the native habitat suggests it might be an excellent winter-flowering species in the Southern States. Its performance will be one of our future objectives since we

Dr. Creech and T. Tamura at Nambu Garden, Hirado Island, Japan, studying and writing descriptions of the flowers of Hirado azaleas.

Dr. Edward Corbett passes giant rhododendron on a Himalayan trail in northern India during the 1965 exploration sponsored jointly by Longwood Gardens and the Agricultural Research Service of the U.S.D.A. Below, Dr. Corbett and Dr. Richard Lighty collecting seed of *Cornus coreana* on the 1966 Korean expedition.



now have collections from various localities in the Himalayas.

Years ago this cherry was catalogued in southern California nurseries indicating it flowered in November. One cannot be certain that this was not merely based on the literature, or that the correct species was even offered. Although the USDA introduced seed from Darjeeling a number of times, *P. cerasoides* was never established successfully.

In 1963, we were fortunate to be able to conduct an exploration for fruits and ornamentals under the cultural exchange program with the USSR. The ARS-Longwood agreement supported the ornamental collecting, again pointing up the advantages of public and private cooperation. Plants were collected from the cold, dry regions of Central Asia. Visits were made to the botanic gardens in Leningrad and the Crimea, which are equal to those of western Europe despite the changes in ideology since the time of the Czars. Many of the intimate gardens designed for enjoyment of the few have been opened to the general public. At the Nikitsky Botanic Garden, founded in 1812 in the Crimea, ornamental species native to China have been planted in great numbers.

Unfortunately, new introductions from China had all but ceased at the time of our visit. Although we collected plants freely, both in the wild and at various horticultural institutions, the important aspect from a long-range standpoint was the renewal of relationships with the many ornamental horticulturists in the Soviet Union. This has been an important step, for our last prior expedition to the USSR was in the early 1930's.

Value of Today's Explorations

In each of the explorations discussed here, we have attempted to collect in the centers of origin of our cultivated ornamentals. This is often a retracing of the journeys of earlier explorers. But we know so much more about our plant needs now. We have accumulated the observations from years of testing and

A crowd of curious Nepalese in a mountain village surround Dr. Francis de Vos when he is in west-central Nepal collecting plants.

plant improvement. Armed with the knowledge gained from the written record of previous expeditions and the data on plant performance, today's plant explorer stands to contribute far more than did his predecessors. Documentation is one aspect of exploration that is often overlooked. The ARS-Longwood program has a decided advantage over other efforts in that all plants collected are described in the USDA Plant Inventories for posterity. The journals of the expeditions and pertinent notations on the collecting localities appear as formal publications of the Department.

Much of the credit for the success of this program goes to Dr. Russell Seibert, Director of Longwood Gardens, who conceived the idea. For this contribution to American horticulture and for furthering the interests of plant introduction, Dr. Seibert was awarded The Meyer Memorial Medal for Plant Introduction at the 1966 International Horticultural Congress.

For historical purposes, a chronological listing of the ARS-Longwood explor-

(*Concluded on page* 86)

Dr. de Vos, behind a gigantic leaf cluster of *Rhododendron falconeri*.

Longwood Gardens

Ginkgo tree planted by the Peirce twins, George and Jashua, about 1789, at the one-time Peirce Arboretum, now part of Longwood Gardens in Kennett Square, Pa. The 105-foot tree is nearly 13 feet in circumference 3 feet from the ground.

Clay Lancaster

Camperdown elm planted in Prospect Park, Brooklyn, in 1872. The scion is believed to have been taken from the parent tree in Scotland and grafted onto the trunk before 1850.

This cedar-of-Lebanon (*Cedrus libani*), now shading a playground in Queens, stands on the site of the old Parsons homestead on 37th Avenue, near Parsons Boulevard, only a short distance from the famous weeping beech shown at the left.

Brooklyn Botanic Garden

Weeping beech (*Fagus sylvatica pendula*) of Flushing, New York, planted in 1847 by Samuel Parsons, who had obtained a scion from Baron de Mann in Belgium. The tree remains a landmark because of the efforts of Dr. C. Stuart Gager, Brooklyn Botanic Garden's first Director, to keep the site from being used for apartments.

Brooklyn Botanic Garden

Brooklyn Botanic Garden

European hornbeam (*Carpinus betulus*), a species often overlaoked in landscaping. This handsame smaath-barked tree from the F. & F. Nursery was planted at the Brooklyn Batanic Garden in 1924 when about 10 years old.

Brooklyn Botanic Garden

Bald cypress (*Taxadium distichum*) near the carner af Sanfard Avenue and Parsans Boulevard in Queens, very likely planted by the nearby Parsans Nursery. It is ane of several of its kind that barder streets in that vicinity.

Brooklyn Botanic Garden

Hugo de Vries, noted Dutch botanist, planted this native American sweet-gum (*Liquidambar styraciflua*) from the Hicks Nursery in the Brooklyn Botanic Garden's waadland garden in 1912.

The clasely spaced trunks af these katsura trees (*Cercidiphyllum japanicum*), now in Kissena Park in New Yark City's Boraugh of Queens, are remnants af a 19th-century Parsons nursery raw.

Brooklyn Botanic Garden

LONG ISLAND'S FAMOUS NURSERIES

Frederick McGourty, Jr.

LONG ISLAND, one of the cradles of early ornamental horticulture in America, was the home of several outstanding nurseries. The first of these, Prince, was founded about 1737, Parsons followed in 1838, and Hicks in 1853. The last still carries on, although mutedly now. All were grand establishments in a tradition largely lost in our time. All were purveyors of the new, the rare and also the common, most examples of which have long since been forgotten. At its peak each company could lay good claim to being the country's leading nursery. Indeed, in its prime each had a larger list of plants than has any catalogue nursery in the United States today.

Prince in Flushing

In terms of varieties offered the largest was Prince, probably the country's most remarkable nursery of two centuries ago. Located in Flushing, now a town in New York City's Borough of Queens, this firm reached its high point in the 1830's under William Prince, Jr., who proudly referred to his nursery as the Linnaean Botanic Garden. It continued in business until after the Civil War. As did other early nurseries, Prince stressed fruit trees, and one of the owner's long-range goals was to make the then young Republic "free of food imports." However, Prince's chief objective was to become a national institution—"a repository of everything useful or interesting in botany." To that end, the firm solicited seed from plant explorers, including Thomas Nuttall, who delivered to his good friend an entire consignment from a western expedition. Prince also claimed to engage in direct importation from China.

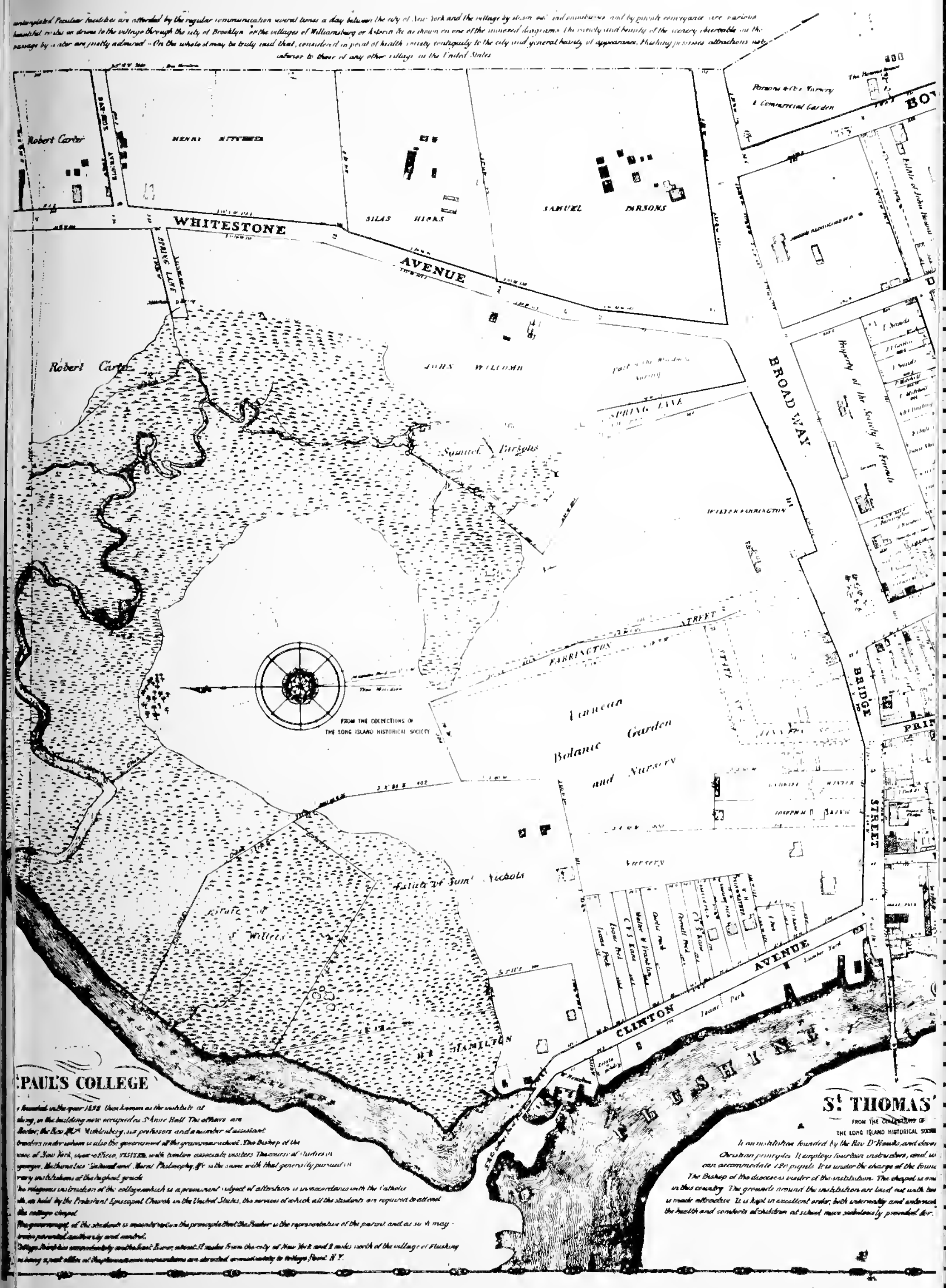
Parsons a Century Later

By the 1840's Prince was challenged by the new Parsons firm, which, despite at least one bankruptcy and several reorganizations, became the leading nursery on Long Island in the latter years of the 19th century, and continued until the early years of the 20th. One of the Parsons' nurseries was located in the town of Flushing, another larger one in what is now Kissena Park. While not ignoring fruit trees, Samuel and Robert Parsons gave particular attention to ornamental trees and shrubs. To serve a more sophisticated public, the Parsons themselves toured Europe in search of new plants and helped to popularize what were then rare species, such as the Japanese maple (*Acer palmatum*) from the Far East. In the 1860's Samuel Parsons, through the American physician and explorer George Hall in Japan, brought into commerce the dwarf Japanese yew (*Taxus cuspidata nana*), before the species itself, "peegee" hydrangea (*Hydrangea paniculata grandiflora*) and Hall's honeysuckle (*Lonicera japonica halliana*). Samuel Parsons soon became the foremost plantsman for the large estates on Long Island and elsewhere.

Hicks of Tree-moving Fame

The Hicks Nursery continued in the Parsons tradition. This Westbury firm, which under Henry Hicks (1870-1954) reached its peak in the 1920's in number of varieties offered, planted many of the great estates that were developed on Long Island around that time. Besides making available many rare plants in cooperation with the Arnold Arboretum and Department of Agriculture plant explorer Frank Meyer, and giving shrewd planting advice to Long Island gardeners, Hicks made a great name in the moving of mature trees.

Even with horse-drawn equipment, moving a 60-foot specimen, was commonplace, and moving an allée of such trees presented no insurmountable problem. In one noteworthy instance a linden whose trunk measured 3 feet in diameter was transplanted from the nursery to the



Long Island Historical Society

Map of a section of Long Island, now in New York City's Borough of Queens, showing the location of the "Linnaean Botanic Garden" (the Prince Nursery), also the Parsons Nursery, in 1841.

Marshall Field estate in Lloyd's Neck. A half-mile swath had to be cut through the woods to get it to its destination from the transporting barge on the waters of Long Island Sound.

Among Hicks' clients were Vincent Astor, William R. Coe, Henry Ford, J. W. Harriman, Otto Kahn, J. P. Morgan, Mrs. Theodore Roosevelt, Charles L. Tiffany, and Harry Payne Whitney. In 1916 some 2,600 specimens of trees and shrubs were given by the Hicks firm to the Brooklyn Botanic Garden. This gift provided the bulk of the early collection of woody plants for the then struggling young botanic garden.

Bloodgood

Another nursery not to be overlooked was founded by James Bloodgood in 1798. While smaller than the others mentioned here, it offered a formidable range of trees and shrubs. It is probably the only 18th century nursery that has lasted into the 20th century. Although it ceased to operate as a corporate entity in 1919, it continued as part of the American Nursery Company, and Bloodgood catalogues were issued for more than a decade longer. The Brooklyn Botanic Garden obtained a number of woody plants from the Bloodgood firm in the 1920's and '30's. A separate Bloodgood nursery having a tenuous link with the old company is located in Doylestown, Pa.

Early Catalogue Listings

The following lists give dates when some trees and shrubs that are now well known first became prominent in the 19th-century catalogues of Prince, Parsons and Hicks. These are not necessarily introductory dates. Where there have been name changes over the years, the most recent name has been listed.

PRINCE

1823 Tree-of-heaven (*Ailanthus altissima*)
Chinese honey-locust (*Gleditsa sinensis*)
Silk-tree (*Albizzia julibrissin*)
Cedar-of-Lebanon (*Cedrus libani*)
Scholar-tree (*Sophora japonica*)
Wayfaring-tree (*Viburnum lantana*)

1827 Thornless honey-locust (*Gleditsia triacanthos inermis*)

1829 Pineapple (*Ananas comosus*)
Papaya (*Carica papaya*)
Coffee (*Coffea arabica*)
Coconut (*Cocos nucifera*)
Mango (*Mangifera indica*)
Goldenrain-tree (*Koelreuteria paniculata*)
Thompson's magnolia (*Magnolia × thompsoniana*)

1832 Weeping scholar-tree (*Sophora japonica pendula*)
Saucer magnolia (*Magnolia × soulangeana*)
Japanese flowering cherry (*Prunus serrulata*)

1835-36 Japanese privet (*Ligustrum japonicum*)

1844-45 Empress-tree (*Paulownia tomentosa*)
Small-leaved cotoneaster (*Cotoneaster microphylla*)
Oregon holly-grape (*Mahonia aquifolium*)

1856 Green-stem forsythia (*Forsythia viridissima*)

1860-61 Weeping forsythia (*Forsythia suspensa*)
Rose glory-bower (*Clerodendron bungei*)
Japanese snowball (*Viburnum plicatum*)

PARSONS

1845 Douglas-fir (*Pseudotsuga menziesii*)
Poison-ivy (*Rhus toxicodendron*)

1860 Weeping forsythia (*Forsythia suspensa*)

1861 Japanese cryptomeria (*Cryptomeria japonica*)

1862 Chinese redbud (*Cercis chinensis*)
Nordmann fir (*Abies nordmanniana*)

1873 "Peegee" hydrangea (*Hydrangea paniculata grandiflora*)
Hall's honeysuckle (*Lonicera japonica halliana*)
Golden Sawara false-cypress (*Chamaecyparis pisifera aurea*)
Moss Sawara false-cypress (*C. p. squarrosa*)
Sargent weeping hemlock (*Tsuga canadensis pendula*)

1876-77 Common pearl-bush (*Exochorda racemosa*)
Hinoki false-cypress (*Chamaecyparis obtusa*)
Japanese umbrella-pine (*Sciadopitys verticillata*)
Star magnolia (*Magnolia stellata*)
Lenne's magnolia (*M. × soulangeana* 'Lennei')

(*Concluded on page* 82)

Hicks Nursery

Hicks Nursery of Hicksville, Long Island, won renown in the late 19th century for its skillful moving of large trees. Above, 12 horses aid in the moving of this enormous shipmast locust. Below, the roots of another monstrous tree are made fast by radiating poles with a spread of 30 feet. The poles are held in place by four circular iron bands.

Hicks Nursery

Prince House Soon to Be Razed; Flushing Landmark 162 Years Old

Historic Mansion, Now Shabby and Boarded Up, Was Visited by Washington and Lafayette—Taken for Unpaid Taxes

The Prince House, landmark of old Flushing and resplendent reminder of colonial days on Long Island, will be razed within the next few weeks, after a history of 162 years.

The nineteen-room mansion, which is as old as American democracy itself and once sheltered General George Washington and the Marquis de Lafayette, will be torn down for non-payment of taxes.

In 1939 efforts were made to have the house moved to the New York World's Fair as a historic colonial homestead, but they were of no avail. Later still, Park Commissioner Robert Moses rejected a proposal to have it moved to Flushing Meadow Park. In the last few years it has served as a rooming house and as a club.

Stripped of its furnishings and heirlooms, all of which have been taken to New Mexico, the present home of the surviving members of the old Prince family, the house, at Northern Boulevard and Lawrence Street, is surrounded now by a gasoline station and advertising billboards.

The shabby, unpainted building is boarded up and the police visit it regularly to rout tramps who occasionally take refuge in it.

Mrs. Charlotte Collins Henry, a sister of LeBaron Bradford Prince, former Governor of New Mexico who returned to the old Flushing homestead in 1925 to die, was the last of the family to occupy Prince House. She died in 1926 at the age of 99. The present heirs are Mrs. Florence Prince Barto and William Bradford Prince, both of Santa Fe, N. M., and Bradford Gill of Chicago, grandson of Mrs. Charlotte Prince Henry.

Old-timers in Flushing recall that the present Prince House in Flushing was not the first. William Prince and his father, Robert, came to Flushing in 1725 and erected a house on Lawrence Street north of what was then known as Broadway. Their visitors included the Duke of Clarence, who later became King Edward IV of England. The first house was taken down in 1863. Yesterday marked the 153d anniversary of Washington's visit to Flushing and the Prince nurseries on Oct. 10, 1789. He wrote in his diary of the trip:

"Pursuant to an engagement formed Thursday last, I set off in my Barge to visit Mr. Prince's fruit gardens and shrubberies at Flushing, L. I. The Vice President [John Adams], Governor of the State [George Clinton], Mr. Izard, Colonel Smith and Major Jackson accompanied me.

"These gardens, except in the number of young trees, did not answer my expectations. The shrubs were trifling and the flowers not at all numerous."

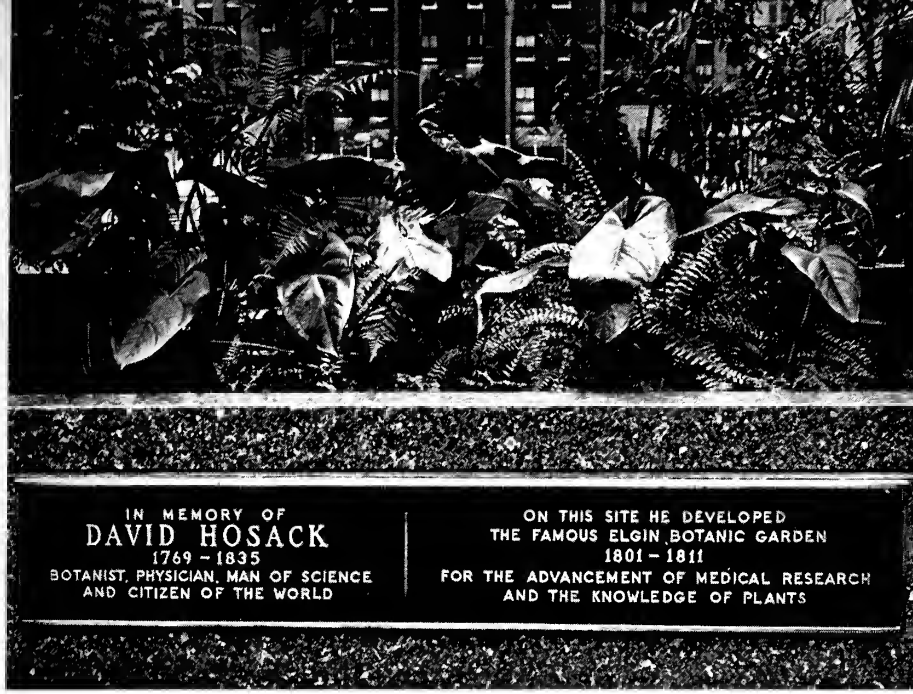
The Prince homestead and its French gardens were the objects of several visits from the Marquis de Lafayette. The nurseries extended over 120 acres on both sides of what is now Northern Boulevard. These nurseries were filled with rare domestic and imported trees and shrubs.

Succeeding members of the Prince family maintained an active interest in horticulture. Their interests, however, also extended to business and scholarship. William Prince 2d organized a company in 1800 and constructed the first bridge across the Flushing River. He aided also in laying plank roads to Brooklyn and Hempstead.

With the Civil War, William Prince 4th enlisted in the Union Army and had a brilliant military career. He died in 1880 and as a bachelor ended the direct line of William Prince that for more than a century played a leading part in the development of the Flushing community.

Courtesy of The New York Times

End of a landmark—the Prince house, which dated from Colonial days. From *The New York Times* of October 11, 1942.



At Rockefeller Center in New York City, David Hosack's Elgin Botanic Garden of the early 19th century is appropriately memorialized.

THE ELGIN BOTANIC GARDEN

VISITORS to New York's Rockefeller Center may be surprised to learn that it was the location of one of America's early botanic gardens. In 1801 David Hosack (1769-1835), a noted physician,* Columbia Professor of *materia medica,* and one of the founders of Bellevue Hospital, purchased twenty acres from the City for $4,807.36 on the then outskirts of New York. Dr. Hosack was especially interested in having a collection of medicinal plants for his students, but he also wanted his institution, which he named the Elgin Botanic Garden, to have a wide range of plants, agricultural, native, and exotic.

Between the current 50 and 51 Streets Dr. Hosack constructed greenhouses and hothouses, and by 1806 most of the new land was in cultivation. Curator Frederick Pursh here identified plants from the Lewis and Clark expedition. Besides John Torrey, one of Hosack's most famous students, the Garden attracted the leading botanical figures of the day, including Le Conte, William Bartram, Michaux and Doughty.

Expenses rose and, despite his own contributions of over $100,000, Hosack found that he could no longer maintain the Garden. The Garden was too geographically remote from the still small city (population 125,000) and popular support never came. In 1811 he sold the property to the State, and it soon came into the possession of Columbia University. By 1823, according to David Douglas (of the Douglas-fir), the Garden was in ruins. The Garden was eventually given up for lack of funds, various parcels of land were sold, and in 1929, Columbia leased the remainder to John D. Rockefeller, Jr., who constructed the well known Rockefeller Center on this location.

F. McG.

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* Among Hosack's patients were De Witt Clinton, Robert Fulton and Alexander Hamilton, attended in his last hours after his unsuccessful 1804 duel with Aaron Burr.

TWO INTREPID PLANTSMEN—FRANK N. MEYER & JOSEPH F. ROCK

Bernard Harkness

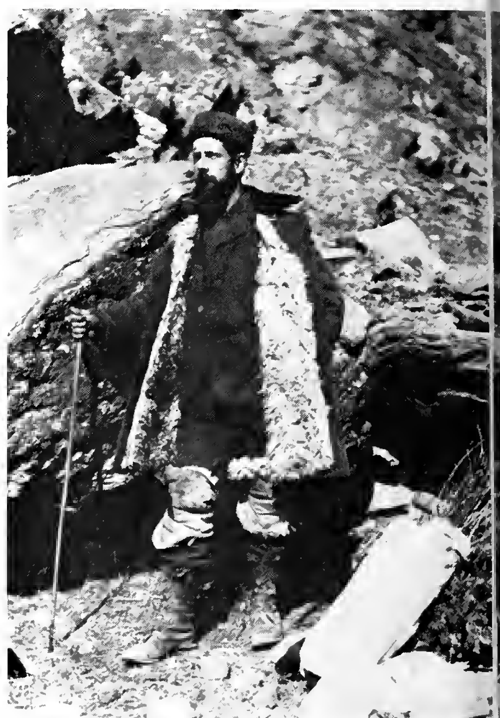
ON one of our national capital's steamy summer days in 1905, there was an interview of great consequence to horticulture when David Fairchild met and liked from the start a 30-year-old man from Holland, Frank N. Meyer. Fairchild was then with the U.S. Department of Agriculture's Office of Foreign Seed and Plant Introduction, as Agricultural Explorer.

Frank N. Meyer

From that first meeting Dr. Fairchild realized that he had the man he needed to send to China—a man who, when he wanted to see Mount Vernon, had walked there from Washington, hence one who would not be dismayed by the foot-trails of the interior of China. Impressive, too, was his devotion to plants; in his youth in Amsterdam he had worked as a gardener and had achieved there finally a position with Hugo de Vries.

After coming to America, Meyer had been to Cuba, Mexico and California and had earned a reputation for being strangely erratic and restless. Yet, during the next 13 years his wanderings were purposeful and richly rewarding to his governmental sponsors. Apparently he bore most understandingly with a bureaucracy which required him to secure a receipt for every expenditure of more than fifty cents.

From 1905 to 1908 Meyer traveled through North China, Manchuria and North Korea and began his contributions that were to enrich our economic and ornamental plant resources by some 2500 introductions. He had charmed his correspondents with letters from the field; on his return his photographs and recollections were equally well received. Henry Hicks took him to Oyster Bay to call on President Theodore Roosevelt and a later presidential message to Congress on conservation of natural resources was uniquely illustrated with Meyer's photographs of the results of deforestation in the Wu Tai Shan mountain range.



U. S. Department of Agriculture

F. N. Meyer returning from a successful raid in the high mountains of China, 1908, tired but satisfied. (From "Travels of a Plant Hunter" in *American Foreign Service Journal*, November, 1923.)

New Chestnut Stock

In deference to Meyer's liking for new territory to explore, his next trip from 1909 to 1911 was to the Caucasus, Turkestan and Siberia. His third trip through northwestern China into Kansu to the Tibetan border brought new chest-

nut stock for plant breeders attempting to replace the American chestnut. Another introduction, a dwarf elm (*Ulmus pumila*), proved to have great importance to the Middle West.

In 1916 Meyer started his fourth and last trip by collecting seed from the wild pear forests about Jehol, north of Peking. In June of 1918 after being detained in Ichang by fighting forces for several months, he became ill and on the trip out by the Yangtze River disappeared from the steamer. His body was found and rests now in Shanghai; he had lived but forty-three years.

By Meyer's will, one thousand dollars was left to his colleagues in Washington. They in turn arranged for the money to go to set up the Meyer Memorial Medal, administered by the American Genetic Association and awarded for merit in the field of plant introduction. The most recent of such awards was in 1966 to Dr. Russell J. Seibert, who, as director of Longwood Gardens, is responsible for a considerable part of present plant exploration from this country.

Meyer's name is joined to the Chinese plants *Juniperus squamata* var. *meyeri*, *Picea meyeri*, *Syringa meyeri*, and to the Korean *Prunus meyeri*.

Joseph F. Rock

Austria, where he was born in 1884, was the native land of Dr. Joseph F. Rock. In his early youth he began mastering languages, including such divergent tongues as Arabic, Chinese and Hungarian until in later years he could begin communicating almost instantly in whatever new language area he found himself. First coming to New York in 1905, he studied for a time at the University of Texas to attain proficiency in English

Caravan of J. F. Rock and party camping under a banyan tree (*Ficus religiosa*) in Yunnan in 1922. *U. S. Department of Agriculture*

and secured U. S. citizenship in 1913. Tuberculosis was a real threat to his health in his first years in this country but a change of residence to Hawaii helped him. There, in 1907, he started his teaching career and his botanical association with the Bernice P. Bishop Museum. The next year he collected seeds of Hawaiian plants and started an herbarium for the Territory's Division of Forestry. Similar work was done for the College of Hawaii beginning in 1911.

In 1914, twenty acres of the college campus was turned over to Dr. Rock for a scientific plant collection. In four years' time the plantings numbered five hundred. A recent inventory of the succeeding campus tree planting of the University of Hawaii numbers 560 species including a banuyo tree, *Wallaceodendron celebicum,* which is dedicated to Joseph F. Rock as a memorial. Two books describing Hawaiian trees were published in this period and a listing made of the plants growing on the estate which later became the Foster Botanical Garden.

U. S. Department of Agriculture
J. F. Rock as he appeared in 1920.

U.S.D.A. Explorations

His plant explorations for the U. S. Department of Agriculture began in 1920 with an assignment to Burma, Siam and Assam to study the source of a botanical drug for the treatment of leprosy. On its completion he turned to a new cultural home, China, where he collected in Yunnan.

In the files of the herbarium at Rochester's Highland Park are cards 59436 to 59631 describing the collections of *Rhododendron* species made under the auspices of the National Geographic Society in a 1924 seed distribution. Unfortunately, on most of the cards there is a notation of no germination. Of what did germinate, no Yunnan rhododendrons survive. In milder climates where better success was had with Rock's seed, a number of superior forms of rhododendron are associated with his introduction numbers. Some 493 species of rhododendron were sent out from Rock's explorations.

Soon he began his geographical and ethnological studies which continued for the rest of his life. Later sponsors were the Arnold Arboretum and the Harvard Museum of Comparative Zoology. Particular appreciation has been expressed for Rock's expedition to Kansu Province in 1925 where the northern climate limited the range of species to be found, but with results of considerable import to tree and shrub plantings of the Canadian provinces and the midwestern prairie states. Various caraganas and spruces have proven especially valuable for the severe climates in this area.

Beginning with "Hunting the Chaulmoogra Tree," detailing his leprosy-cure exploration in the *National Geographic* in 1922, Rock continued to appear frequently in that magazine through the next thirteen years. Later trips to China were increasingly difficult owing to the troubled political course of that country and there were disheartening losses of manuscripts. Valuable studies were continued of remote peoples, in particular the Na-khi tribe.

In 1962, Dr. Rock's life ended on the island of Oahu where he was pursuing his life-long interests until the last. ◆

U. S. Department of Agriculture

The large collecting cart used by F. N. Meyer, with over 1,000 pounds of baggage in it, drawn by three mules and a strong horse. At this point in 1911 the party was trekking through a piece of sandy and alkaline desert near Uredalik, Chinese Turkestan. Sandy dunes which rise here and there above the intensely monotonous country are covered with reeds where swampy or with tamarisk bushes where drier.

COLLECTING THEN AND NOW

Plant collecting in the early 1900's was very different from what it is today. Many weeks were spent on slow boats crossing the Atlantic and Pacific oceans. Then a long journey up the Yangtze and travel on foot with an army of porters who carried all supplies and collected plants on their backs. The plants moved slowly and not all survived.

Now the plant collector arrives in the field in a few hours and travels in cars or trucks. Polyethylene wrapping and jet planes bring the collected plants, cuttings and seeds to skilled propagators within a few hours.

THOMAS JEFFERSON ON GARDENING

From a letter to Charles W. Peale, August 20, 1811

"I have often thought that if heaven had given me choice of my position and calling, it should have been on a rich spot of earth, well watered, and near a good market for the production of this garden. No occupation is so delightful to me as the culture of the earth, and no culture comparable to that of the garden. Such a variety of subjects, some one always coming to perfection, the failure of one thing repaired by the success of another, and instead of one harvest a continued one through the year. Under a total want of demand except for our family table, I am still devoted to the garden. But though an old man, I am but a young gardener."

From "Thomas Jefferson's Garden Book" edited by Edwin Morris Betts. Published by the American Philosophical Society, Philadelphia, 1944.

PLANT EXPLORER DAVID FAIRCHILD

Lucita H. Wait

DAVID GRANDISON FAIRCHILD (1869-1954), through an extraordinary combination of personal attributes and amazing good fortune, was one of the happiest and most successful men in his field. Born into the home of a scholar and administrator (his father was president of Michigan State College of Agriculture and Applied Science, the first state agricultural college in the United States), he received a fine education. Later his uncle, Prof. Byron D. Halstead, induced him to study mycology and plant pathology, which became his greatest interest for several years. This led him later to do pioneer work in fungicides and in the development of Bordeaux mixture as a spray for grape vines.

After a few years as an employee of the U. S. Department of Agriculture, he resigned to go to Europe to study under some of the prominent biologists then living. By one of "the many coincidences of my life," as he called them, he met Mr. Barbour Lathrop on board ship going to Europe. Lathrop was a wealthy bachelor and world traveler, who immediately took an interest in the young scientist. Due to this encounter, Fairchild was to travel around the world many times.

After two and a half years of study abroad, Mr. Lathrop made it possible for David to go to Java, as he had longed to do, and there began his life-long involvement with exotic plants, and his genius for collecting and introducing them to the United States. His trained mind, his unfailing curiosity, his interest in everything and everyone around him, and his unusually attractive personality combined to make him an outstanding plant explorer.

Asia Eluded Him

Strangely enough, although he longed to travel and collect on the mainland of Asia, he was never able to do so except for very brief stops in China, Siam (Thailand), Cambodia (South Viet Nam) and India. Years later, as head of the Office of Plant Introduction of the U. S. Department of Agriculture, he was able to collect in continental Asia vicariously, by sending such explorers as Frank N. Meyer, P. H. Dorsett, W. J. Morse, J. F. Rock. They shipped back seeds of economic plants which have since become very important elements in our agriculture, including Durum wheats, soybeans, the tung-oil-trees (*Aleurites fordii*), various grasses and other valuable plants which now cover millions of acres in America and contribute immensely to our well-being. For example, Dorsett and Morse combed China for soybean varieties, returning with almost eight hundred kinds, from which were chosen the most suitable ones for our climate and soils.

David Fairchild's personal experiences as a plant explorer in the Orient took place almost entirely in the great archipelagos of the southwestern Pacific. His love affair with the islands began when he arrived in Java in 1896, accompanying the noted Dutch plant scientist Dr. Melchior Treub. While his eight-month stay at the Buitenzorg (now Bogor) Botanical Gardens was chiefly devoted to the study of mushroom-growing termites, he took time to study and delight in the profusion of unfamiliar tropical plants.

When his sponsor, Mr. Lathrop, appeared unexpectedly and saw his keen interest in plants he persuaded Fairchild that his real career should be that of exploring the world for plants of economic value and introducing them into America. This was the beginning of eight years of intermittent travel with Lathrop. During this time they circled the globe many

times, Fairchild always on the alert for new and valuable grains, fruits, timber trees, and other useful plants, but always managing to include a few ornamentals which he found outstanding.

Islands of South Pacific

During his lifetime David visited Ceylon five times, Indonesia four times, Japan three times, the Celebes twice, the Philippines twice, Singapore twice, Sumatra twice and a number of other islands once each. This was in addition to his brief stops on the mainland of Asia and his extensive travels in Europe, South America, Africa, the Near East and of course in the United States, which are not covered in this paper.

During one of his visits to Japan he made arrangements for the importation of many kinds of bamboos, and of the Japanese flowering cherry trees which have become one of the outstanding attractions of our nation's capital.

In July 1898, Fairchild was appointed Chief of the newly established Section of Seed and Plant Introduction, U. S. Department of Agriculture. Through Mr. Lathrop and other friends in Washington he met a number of outstanding personalities, including Alexander Graham Bell, his future father-in-law. Fairchild considered Bell to be one of America's greatest minds, due to his many scientific achievements and wide range of interests. The most outstanding person he met, from David's point of view, was Dr. Bell's daughter Marion, whom he married in 1905. Throughout the remainder of his life she was his inspiring companion, mentor, and helper in many ways, specially in later years as a buffer between Dr. Fairchild and his adoring public.

Two rather remarkable events, besides his great friendship with Barbour Lathrop and his marriage, illustrate the extraordinary good fortune which was his. The first is described in Dr. Fairchild's book "Exploring for Plants" (Macmillan, 1930), which begins with these words: "Some of the greatest things that have happened to me have happened on boats. It was on a boat off the coast of Malacca that I promised Mr. Barbour Lathrop that I would devote my life to the introduction of useful plants into America. And it was on the houseboat of Mr. Allison V. Armour, anchored off the Brickell wharf in the Miami River, that I agreed that if he would buy a boat and equip it for the collecting of living plants, I would go with him on an expedition."

The Yacht Utowana

Mr. Armour did buy a small freighter and remodel it extensively for a long scientific trip. In this yacht *Utowana* Mr. Armour, Dr. and Mrs. Fairchild and a group of helpers and friends spent many months traveling around the African continent, with a side trip to Ceylon, Sumatra and Java.

The third of the "greatest things" in Fairchild's life connected with boats was the Archbold Expedition in 1940, seven years after he retired from the Department of Agriculture. He tells of this trip in "Garden Islands of the Great East" (Scribner's 1944). Mrs. Anne Archbold asked him where he would most like to go exploring for plants. He had always wanted to go on a leisurely collecting trip to the Moluccas, and quickly said so.

Mrs. Archbold suggested that she have a comfortable yacht built in Hong Kong, that Dr. and Mrs. Fairchild meet her in the Philippines with a party of collectors and photographers, and that they plan to spend a year or more in the great archipelagos, visiting remote islands. Naturally, they were delighted to accept. The Chinese junk *Cheng Ho* was built and carried its passengers through many an adventure cruising the Philippines, Celebes, Spice Islands and Java. Unfortunately, the arrival of World War II in the South Pacific put an end to the expedition.

From all these travels there poured back to the United States and other parts of the western hemisphere thousands of seeds, cuttings and living plants, to be distributed to experiment stations in the most suitable climates and soils available. Here they lived and prospered or died,

(*Concluded on next page*)

COMMON WEEDS FROM EUROPE

EUROPE has given us some of her finest garden flowers, including the bearded iris (*Iris germanica*), daffodil (*Narcissus pseudo-narcissus*), foxglove (*Digitalis purpurea*), Shasta daisy (*Chrysanthemum maximum*), pansy (*Viola tricolor hortensis*), English primrose (*Primula vulgaris*), and a host of others. She has also given us some of her most prolific weeds. Some came as ornamentals, others as food and medicinal plants, and still others as unintended "stowaways." Many an American gardener will be surprised that the old acquaintances on the following list (compiled from John M. Fogg, Jr., *Weeds of Lawn and Garden*, Philadelphia, University of Pennsylvania Press, 1956) are European natives, unknown in this country until the coming of the settler. There are many others.

Annual blue grass (*Poa annua*)
Barnyard grass(*Echinochloa crus-galli*)
Bitter nightshade (*Solanum dulcamara*)
Bouncing Bet (*Saponaria officinalis*)
Broad-leaved plantain (*Plantago major*)
Burdock (*Arctium minus*)
Butter-and-eggs (*Linaria vulgaris*)
Bulbous buttercup (*Ranunculus bulbosus*)
Tall buttercup (*R. acris*)
"Canada" thistle (*Cirsium arvense*)
Catnip (*Nepeta cataria*)
Chicory (*Cichorium intybus*)
Common chickweed (*Stellaria media*)
Common mullein (*Verbascum thapsus*)
Common St. Johnswort (*Hypericum perforatum*)
Creeping Charlie (*Lysimachia nummularia*)
Creeping Jenny (Bindweed) (*Convolvulus arvensis*)
Cypress spurge (*Euphorbia cyparissias*)
Dandelion (*Taraxacum officinale*)
Devil's paintbrush (*Hieracium aurantiacum*)
Field garlic (*Allium vineale*)
Field peppergrass (*Lepidium campestre*)
Goose grass (*Eleusine indica*)
Ground-ivy (*Nepeta hederacea*)
Hedge mustard (*Sisymbrium officinale*)
Lady's thumb (*Polygonum persicaria*)
Lamb's quarters (*Chenopodium album*)
Orchard grass (*Dactylis glomerata*)
Ox-eye daisy (*Chrysanthemum leucanthemum*)
Purslane (*Portulaca oleracea*)
Queen Anne's lace (*Daucus carota*)
Red clover (*Trifolium pratense*)
Sheep sorrel (*Rumex acetosella*)
Shepherd's purse (*Capsella bursa-pastoris*)
Smooth crabgrass (*Digitaria ischaemum*)
Spotted knapweed (*Centaurea maculosa*)
Sulfur cinquefoil (*Potentilla recta*)
Tansy (*Tanacetum vulgare*)
Viper's bugloss (*Echium vulgare*)
White campion (*Lychnis alba*)
Yellow foxtail (*Setaria lutescens*)
Yellow wood-sorrel (*Oxalis europaea*)

F. McG.

(*Continued from page* 69)

according to their fates. In the beauty of flowers, in the flavor of fruits, in the usefulness of farm products David Fairchild and the devoted men who worked with him live on, and our lives are enriched. ◆

FOR FURTHER READING

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THE GREAT MULBERRY MANIA


GREAT AUCTION SALE

OF

Morus

Multicaulis

TREES,

On the 1st of October next,

At PRINCE'S Nurseries,

FLUSHING, NEAR NEW-YORK.

150,000 splendid Trees of the Genuine Morus Multicaulis.

50,000 Large Leaved Alpine Mulberry, very hardy.

25,000 Rose of Lombardy Mulberry, and a few thousand of the New American Multicaulis, raised from genuine seeds. The leaves are very large, and the trees exceedingly hardy.

The terms will be very liberal for notes or mortgages, and every tree will positively be sold, without reserve, to the highest bidder.

Massachusetts Horticultural Society

AMERICA has had its share of horticultural fads. At one time or another in our history, pear trees, plants with variegated leaves, and trees with a weeping habit have all had a popularity out of proportion to their merit. Typical was the appearance of Tea's weeping mulberry (*Morus alba pendula*) in the 1890's which prompted at least one nursery (Hicks) to call it the "tree of the century." Tea's weeping mulberry, which seldom appears in catalogues today, was one of the best selling woody plants in the business at the turn of the century.

Strangely, one of America's most unusual fads concerned another now forgotten mulberry, *Morus alba multicaulis*, the so-called silkworm mulberry. This tree has larger leaves and a more shrubby habit than the common white mulberry (*Morus alba*), a tree introduced here in early colonial times in the vain hope of establishing a thriving silk industry. In the great silk mania that occurred here between 1826 and 1841 probably no tree was more widely sold than the "silkworm mulberry." Certainly none received more accolades. Congress, worried about rising silk imports, promulgated an Act in 1825 to encourage its planting, the Secretary of the Treasury issued a 220-page manual on it, and state legislatures gave it glowing testimonials. At least eighteen books were written in this period on the silkworm and mulberry, and no less than four monthly magazines were devoted to the subject.

In 1824, the "silkworm mulberry," originally from China, found its way to France by way of the Philippines. It created an immediate sensation in France, and two years later William Prince, Jr., imported it to his Flushing, Long Island, nursery. Soon, many nurserymen neglected their other stock to concentrate on the "silkworm mulberry." At the height of the bubble, the fast growing, easily propagated tree sold for up to $5.00. Indeed, there is one remarkable anecdote of a Connecticut nurseryman who auctioned two trees not even one year old for $100 each, and then withheld further sales because he did not consider the bidding sufficiently spirited. Trees of other species then generally sold for thirty to fifty cents. At least one nurseryman grew 30,000 "silkworm mulberries" on a single acre and sold them for $30,000 at the end of the year!

The "silkworm mulberry" was much more tender than the common white mulberry, which is still a notable weed tree in much of the United States. Eventually the price dropped, and near the end of the craze, trees were selling for as little as one cent each. ◆ *F.McG.*

See U. P. Hedrick, *A History of Horticulture in America to 1860* (New York: Oxford University Press, 1950), pp. 216-218, and L. H. Bailey, *Sketch of the Evolution of Our Native Fruits* (New York: The Macmillan Company, 1911), 3rd ed., pp. 141-155.

THE PLANT DISCOVERIES OF ERNEST H. WILSON

George L. Slate

Genereux

The successful search for the dove-tree in China gave Wilson his start as a collector of new plants that today are widely used in gardens.

ERNEST H. Wilson's plant explorations were well summarized in these words from the dedication of the 145th volume of *Curtis's Botanical Magazine:* "To Ernest Henry Wilson, whose ardour as an explorer and judgment as a collector have added to our gardens many eastern Asiatic plants. . ."

Wilson made four trips to China from 1899 to 1911. Later he collected extensively in Japan, Korea and Formosa. He introduced into the gardens of the Western World more than 1500 new plants, many of which are now widely grown. Many thousands of herbarium specimens were collected and deposited into the herbaria of botanical gardens and arboretums to be used in the studies of the plants of these regions.

His first trip in 1899 was for Veitch & Sons in England, a nursery long noted for introducing into cultivation new plants from foreign lands. The chief object of this trip was the introduction of *Davidia involucrata,* later called the dove tree. He went to see Dr. A. Henry, a British medical officer long resident in Western China, who had sent plants and herbarium specimens to England. Henry gave the young explorer much advice and assistance. He also told him where to find a particular davidia tree.

Wilson returned to Hong Kong, then went to Shanghai and up the Yangtze to Ichang. However, when he finally reached the davidia tree it had been cut and used in building a house. He soon discovered that he was in the midst of an interesting flora rich in plants new to botany and horticulture. Wilson collected industriously in Hupeh during 1900 and 1902, using Ichang as his headquarters. He found more plants of the davidia and collected more seeds of that tree than he ever saw again.

Further Trips Undertaken

His first trip was so successful that in 1903 Veitch sent him again to China, where he collected in northern and western Szechuan. One of his finds was *Meconopsis punicea,* a large showy red poppy. From this trip, also very successful, he returned to England in March, 1905.

Wilson's success as a collector of seeds, living plants and herbarium specimens

attracted the attention of Professor C. S. Sargent of the Arnold Arboretum, who sent him on a third expedition to China where he arrived in Ichang early in the spring of 1907. Western Hupeh was explored that summer. In 1908 western Szechuan was his collecting ground, the Min Valley and Mt. Wa and Mt. Omei being especially rewarding.

His fourth trip, which started in 1910, was to collect seeds of the conifers which had not fruited in 1908. While returning from Sungpan where he had made arrangements for digging bulbs of the Regal lily, his party was hit by a rock slide and his leg was broken. This caused him much trouble and prevented further field work for that season. His collectors, now well-trained and experienced, collected the bulbs and cones so that the objectives of the trip were realized.

In 1914 he collected in Japan where he paid special attention to the ornamental cherries. In 1917 he made a sixth trip to the Far East where he collected in the Liukiu and Bonin Islands, Korea, Japan and Formosa. A large number of seeds, plants and herbarium specimens were collected on this expedition.

Wilson gathered and introduced into cultivation more plants than any other collector. He introduced more than a thousand species previously unknown in cultivation and collected about 16,000 numbers of herbarium specimens with many duplicates. His plants are widely grown in gardens in the temperate and subtropical regions.

He was fortunate to collect from a rich flora in a region with a climate similar to that of the great gardening regions of the world. A high proportion of his plants succeeded in their new homes and many of them were handsome garden plants. Rehder characterized him as "a born plant collector, endowed with a strong physique, robust health, indomitable will power and a deep love of plants. . . He knew how to handle his men and never had any serious trouble in all his expeditions in the Far East."

Of the many plants from Wilson's explorations only a few can be mentioned.

Genereux

In a region of China that was particularly rich in handsome flowering shrubs, Wlison collected beauty-bush (*Kolkwitzia amabilis*) (*above*), a honeysuckle relative that has become well known for its dramatic display of delicate pink flowers in late spring. He also found buddleia (*below*), which is noteworthy for its fragrant, arching spikes of bloom in late summer.

Genereux

Genereux

Regal lilies were among the choice discoveries of Ernest Wilson.

Genereux

Pink clematis (*C. montana rubens*), another Wilson discovery.

Many that are not grown much in this country are successful and popular in England where the climate is better suited to them. Plants well known in America are *Acer griseum, Aconitum wilsonii, Actinidia chinensis, Berberis julianae, B. sargentiana, B. verruculosa, Buddleia davidii magnifica, Buxus koreana microphylla, Cercidiphyllum japonicum sinense, Clematis armandii, C. montana rubens, Cotoneaster* (several species) and *Davidia involucrata.*

Also, *Forsythia ovata, Hydrangea sargentiana, Kolkwitzia amabilis, Lilium davidi, L. regale, Lonicera nitida, Magnolia wilsonii, Malus theifera, M. toringoides, Picea asperata, Pyrus calleryana, Rhododendron* (many species). He did not discover the Kurume azaleas, but was instrumental in having them introduced, along with *Rosa moyesii, Schizophragma integrifolia, Stewartia koreana, Syringa reflexa, Viburnum rhytidophyllum.*

Wilson was a prolific writer. Several monographs dealing with special groups of plants in which he was especially interested were produced. His collections were described in many journal articles. He wrote to popularize his plant introductions and get them established in gardens. His books, especially the "Aristocrat" series, evaluated and described the best in garden plants.

He wrote of his collecting, his travels, China and his adventures in the two-volume "A Naturalist in Western China, 1913" and again in "China, Mother of Gardens" in 1929. He lived from 1876 to 1930. ◆

EARLY AMERICAN NURSERYMEN AND SEEDSMEN

Their founding dates given at the left

1728 BARTRAM, JOHN. Philadelphia, Pa. Naturalist, explorer, hybridizer, and nurseryman. American plants introduced into England. Early Amerieau botanie garden. Although the nursery bore the name John Bartram and Sons, it was actually operated by John Bartram, Jr., from 1777 until his death in 1812. "Kingsess Botanical Garden" was evidently used as an informal name without any legal arrangement.

1750 or earlier PRINCE ROBERT. Flushing, N. Y. Nurseryman. Perhaps the first eommereial nursery in America, under four generations of the family. Fruit trees, ornamentals. Imported extensively. Created new varieties, developed improved cultural techniques. Sold out of the family in late 1860's; closed in 1878.

1746 COOPER, JOSEPH. Gloucester Co., N. J. first in America to make life work of plant improvement by seleetion. Worked with vegetables and fruits.

1755? LAURENS, HENRY. Ansonborough, S.C. Plant collector, nurseryman. Grew the then-known cultivated plants suited to South Carolina.

1763 WATSON, JOHN. Charleston, S. C. Plants and seeds, largest pre-Revolutionary dealer in the South.

1784 LANDRETH, DAVID. Philadelphia, Pa. Seedsman. First seed business in Ameriea. Extensive international trade. Propagated and distributed materials from Lewis and Clark Expedition. Had branch in Charleston, S. C. until the Civil War. Son experimented with machinery for plowing and harvesting. Now part of Buist firm.

1785 SQUIBB, ROBERT. Charleston, S. C. Bought the Watson business. Built up extensive European trade.

1798 BLOODGOOD, JAMES. Flushing, Long Island, New York. Nurseryman with extensive list of trees and shrubs, continuing into the first quarter or more of the 20th eentury.

1802? GARDINER, JOHN and DAVID HEPBURN. Washington, D. C. Nurserymen. Little information about the nursery itself, but their book, "The American Gardener" (1804) shows that they were skilled professionals, trained in England.

1804 M'MAHON, BERNARD. Philadelphia, Pa. Seedsman, nurseryman. Early collector and exporter of seeds of American plants. Received and propagated materials from Lewis and Clark Expedition.

1805 THORBURN, GRANT. New York, N. Y. Seedsman. Opened the first seed and florist shop in New York.

1810? DOWNING, CHARLES. Newburgh, N. Y. Pomologist. Commercial and test orchards, especially pears, apples, plums, named accurately. Brother of Andrew Jackson Downing, America's greatest landscape gardener of the period.

1814 ADLUM, JOHN. Georgetown, D. C. Pomologist. Experimenter in development of native grapes. Introduced Catawba, first native American variety.

1816 STARK, J. H. Louisiana, Mo. Pomologist. First commercial nursery west of Mississippi River. Introdueed grafted stock of best varieties. Leader in development of fruit industry in West.

1818 BRECK, JOSEPH. Boston, Mass. Seedsman. Leader in promotion of horticulture in Massaehusetts.

1822 HOGG, THOMAS. New York, N. Y. Nurseryman, florist. Father and son pioneers in introduction of plants from Japan, many colleeted by son.

1823 KENRICK, WILLIAM. Newton, Mass. Pomologist. Pioneer in seleetion and improvement of fruit varieties.

1823 MANNING, ROBERT. Salem, Mass. Pomologist. Leader in testing, improvement, and identification of fruits. American distributor for J. B. van Mons.

1825 PARMENTIER, ANDRÉ. Brooklyn, N. Y. Nurseryman, grape-grower, landscape designer. Large collection of ornamentals ineluding rare types from Europe. His ideas on design influenced A. J. Downing.

1828 LONGWORTH, NICHOLAS. Cineinnati, Ohio. Pomologist. Leader in commereial grape growing and in de-

velopment of horticulture in the Ohio Valley. Pioneer in strawberry breeding.

1830 HIBBERT, THOMAS and ROBERT BUIST. Philadelphia, Pa. Hibbert established first florist shop in Philadelphia. Partnership with Buist in 1830. Buist skillful propagator and grower, especially roses, verbenas. Introduced poinsettia. Official growers for collections brought by expeditions of Thomas Nuttall.

1830? FEAST, SAMUEL. Baltimore, Md. Nurseryman. Extensive collections of cacti, roses, especially new French varieties and China tea roses. South American plants from seed. Experimented with charcoal as propagating medium. Perfected grafting of cacti.

1830? BRIDGEMAN, THOMAS. New York, N. Y. Seedsman. Opened early seed store, then began to grow his own stocks.

1830? FLOY, MICHAEL. New York, N. Y. Nurseryman. Skillful propagator and breeder, especially camellias.

1834 HOVEY, CHARLES M. Cambridge, Mass. Nurseryman, seedsman. Student of fruit improvement. Extensive collections of ornamentals. His "Hovey" strawberry variety was foundation of commercial strawberry growing.

1838 PARSONS, SAMUEL B. Flushing, N. Y. Nurseryman. Imported many now well known trees and shrubs from Europe and Asia. Had one of the leading nurseries of the day, continuing until 1906.

1838 DREER, HENRY A. Philadelphia, Pa. Seedsman, florist. Fine collection of ornamental trees, dahlias. Extensive list of varieties of seeds of flowers and vegetables of fine quality.

1840 ELLWANGER, GEORGE and PATRICK BARRY. Rochester, N. Y. Pomologists. Introduced fruit growing into western New York State when it was first settled. Barry leader in making Rochester a nursery center.

1847 HENDERSON, PETER. Jersey City, N. J. Market gardener, florist, seedsman. Pioneer in simplifying large-scale operations of nursery management.

1847? LEWELLING, HENDERSON. Salem, Ore. Nurseryman. First nursery in Pacific Northwest, stock carried overland in covered wagons. Founder of orchard and nursery industry of Oregon.

1848 DOUGLAS, ROBERT. Waukegan, Illinois. Nurseryman. Probably the first specialist in growing and selling conifer seedlings for reforestation. A pioneer in large-scale plantings of fruit tree seedling understock.

1850? GREGORY, JAMES J. H. Marblehead, Mass. Seedsman. Specialty vegetables of pedigreed stock. Distributed Hubbard squash etc. One of largest seed businesses in the country.

1852 SAUL, JOHN. Washington, D. C. Nurseryman. Nursery stock, greenhouse plants. Imported novelties from Europe and Central and South America.

1853 MEEHAN, THOMAS. Philadelphia, Pa. Nurseryman. Famous collection of native American trees, also fruits and vegetables. His partner, WILLIAM SAUNDERS originated fixed roofs for greenhouses and introduced hardy Russian apples for the North, also the Navel orange.

1854 HICKS, ISAAC. Westbury, New York. Nurseryman. First specialized in fruit trees, later in ornamentals, particularly conifers. Founder of a firm that continues to this day.

1855 SHINN, JAMES. Niles, Calif. Pomologist, nurseryman. Introduced many fruits and nuts suitable for the South as well as for California.

1856 BERCKMANNS, P. J. A. Augusta, Ga. Pomologist, botanist, landscape gardener. Founder of Fruitland Nursery. Leading pomologist of the South. Introduced and bred many fruits and ornamentals. Early importer of plants from Japan. Introduced Amur privet. Imported and popularized azaleas and camellias for outdoor culture in the South.

1858 BUDD, J. L. Benton, Iowa. Pomologist. Extensive testing, breeding, and introduction of hardy fruits from Russia for the cold Plains States.

1866 ROCK, JOHN. Niles, California. Nurseryman. Had one of the larges nurseries in the United States. E tensive importation of plants frc Australia, India, and Japan.

A BRIEF APPRAISAL OF JOHN BARTRAM

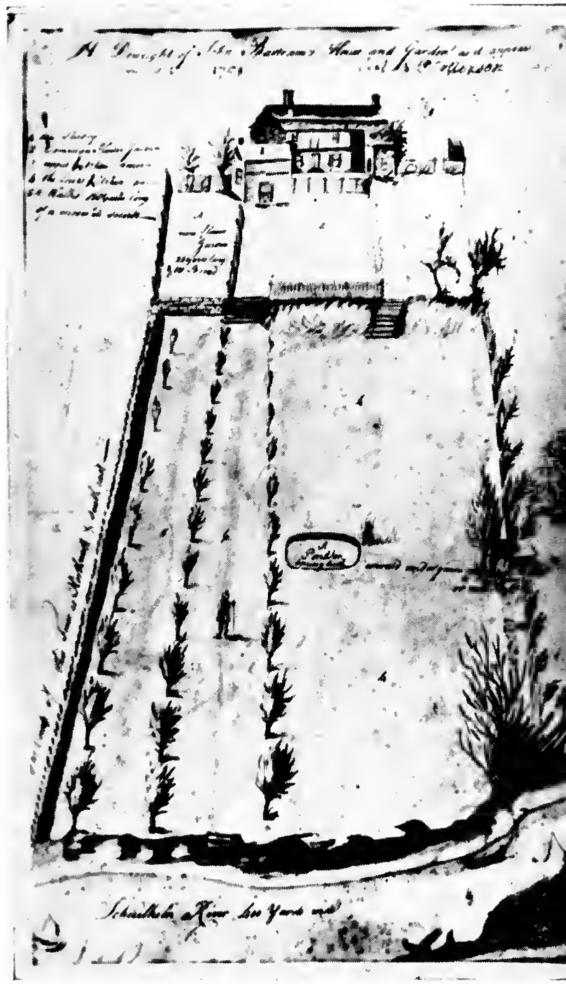
Joseph Ewan

JOHN BARTRAM was essentially a farmer who, at his home near Philadelphia, established a growing and botanic garden rather more than a nursery in its present sense. Bartram's Garden was a meeting place of students of natural history and a mecca for travelers. His cannot be compared with Prince's elaborate establishment on Long Island.

John Bartram was much more than a farmer and nurseryman: he was also a plant explorer. This is made evident in *Observations on the inhabitants, Climate, Soil, Rivers, Productions, Animals and other matters worthy of Notice made by John Bartram in his Travels from Pensilvania to Onondago, Oswego and the Lake Ontario in Canada*, published in London in 1751. The work was reprinted by University Microfilms, Ann Arbor, 1966, as *Travels in Pensilvania and Canada* by John Bartram. Further details of his plant-hunting travels are told in "Diary of a Journey through the Carolinas, Georgia and Florida from July 1, 1765 to April 10, 1766, John Bartram," annotated by Francis Harper.[1] This has maps of his journey.

John Bartram had no technical schooling in botany; he was self-taught. Yet, as Cadwalader Colden wrote to Peter Collinson, November 13, 1744: "It is really surprising what knowledge that man has attained merely by the force of industry and his own genius. He has a lively fancy, and a surprising memory and indefatigable disposition."[2]

Alexander Garden wrote on November 4, 1754, to Colden: "One day Bartram dragged me out of town, and entertained me so agreeably with some devoted botanical thoughts, on oaks, ferns, rocks &c. that I forgot I was hungry till we landed in his house about four miles from [Philadelphia]. There was no parting with him for two days, during which time I breakfasted, dined and supped, slept, and was regaled on botany and mineralogy, in which he had some excellent notions and good thoughts. His garden is a perfect portraiture of himself; here you meet



Courtesy of HORTICULTURE *magazine*

Copy of a 1758 drawing of John Bartram's garden done by his son William and sent to Peter Collinson in London. It was Collinson who commissioned Bartram to seek out American plants for English gardens. The drawing reposed unnoticed for many years in the library of the Earl of Derby.

[1] Published in *Transactions of the American Philosophical Society*, 1942.

[2] *American Journal of Science* 44: 122. 1843.

This print, taken from William Darlington's *Memorials of John Bartram and Humphry Marshall* (Philadelphia: Lindsay & Blakiston, 1849), shows the home of one of America's great pioneer botanists, "built with his own hands, A.D. 1730." It is on the banks of the Schuylkill River at 54th Street and Elmwood Avenue in Philadelphia. In recent years it has been restored under the auspices of the Fairmount Park Commission and the John Bartram Association. An attempt is now being made to restore the garden with plants of Bartram's time.

with a row of rare plants about covered over with weeds, here with a beautiful shrub, even luxuriant amongst briars, and in another corner an elegant and lofty tree lost in common thicket."[3]

In 1765, resentful that Bartram, "a man who can scarcely spell," was made Botanist to the King, Garden, who perhaps coveted the honor, was less generous. Though admitting Bartram was "alert, active, industrious, and indefatigable in his pursuits," he described him as knowing "nothing of the generic characters of a plant, and can neither class them nor describe them; but I see that, from great natural strength of mind and long practice, he has much acquaintance with specific characters; though his knowledge is rude, inaccurate, indistinct, and confused, seldom determining well between species and varieties."

These two quotations from Dr. Garden make it clear that evidence must be examined with caution. Garden, we know, was an impetuous man and given to strong opinions, but his first-hand estimates are valuable. John Bartram was one of the original nine members of the American Philosophical Society, an indication of the appraisal of his contemporaries.[4] ◆

AN EARLY PLANT LIST

JOHN Bartram & Sons' 1792 catalogue was copied *in toto* (apparently) by one of George Washington's private secretaries, Bartholomew Dandridge. The Bartrams' own list was likely printed.

The 106 plants listed are numbered in sequence on five sheets or pages. Preceding many of the numbers is a symbol for the type of soil in which the plant grows naturally. After the botanical name is a figure to indicate the number of plants available (in many instances only one, and seldom more than five). The height of each is given next, then a brief comment, followed in very few instances by

(*Concluded on page* 80)

[3] *American Journal of Science* 44: 132-133. 1843.

[4] See also Joseph Ewan's chronology of John Bartram in the Hafner reprint edition of Darlington's *Memorials of John Bartram and Humphry Marshall* (New York, 1967).

Catalogue of Trees, Shrubs & Plants, of Jn.o Bartram

No.		Plants	feet high	33877
1	1. Rhododendron maximum	2	grow from 6 to 10	Evergreen large rose coloured blossoms
1	2. Ulex europeus E	2.	3 to 4.	Embellished with fruit scented flowers of a fine yellow colour.
2	3. Hypericum Kalmianum	2	..... 3 to 4	profusely garnished with fine Gold coloured blossoms.
	4. H. Angustifolium	3	3 to 6	Evergreen, adorned with fine yellow flowers.
	5 Taxus procumbens		3 to 6.	Evergreen a fine plant full green throughout the year red berries
	6. Buxus aureus E		3 to 10	Elegant with gilt leaf
	7 Daphne mezerium E	2	1 to 3.	An early flowering sweet scented little shrub
	8 Calycanthus floridus	5	4 to 8	Dark purple sweet bloss. some scented like the Pine apple
	9. Berberis canadensis	3	2 to 4.	Berries of a purple and
	10. Aesculus hippocastanum	2.	20, 40 to 60	A magnificent flowering & shady Tree.
	11. Evonimus atropurpur	3	6 to 8.	Its fruit of a bright crimson in the autumn (burning bush)
	12. Fothergilla garduni	6	2 to 4	Early in blossom; flowers in spikes, white & delicate.
	13 Franklinia alatamaha	1	3, 15 to 20.	Flowers large, white & fragrant — native of Georgia
	14 Baccharis	3	4 to 6.	In autumn covered over with white silky down
	15. Laurus aestivalis		5 to 8	Aromatic & beautified with coral red berries
	16. Kalmia angustifolia (with the Gaultheria, or mountain tea)		1 to 2.	Evergreen, garnished with crimson sparkling flowers
	17 Ilex angustifolia.		3 to 6	Evergreen, rare
	18. Dirca palustris	2.	2 to 5	Early in bloom; fine yellow — (Leather wood)
	19 Thuja occidentalis	4 —	16, 30 to 40	A handsome evergreen Tree; beautiful foliage, & odoriferous
	20 Zanthorhiza apiifolia	6	1 to 3.	Singular flowers early

U.S.D.A. Library

A portion of the Bartram catalogue of 1792 as copied by one of George Washington's private secretaries, Bartholomew Dandridge. *F.McG.*

a common name in parentheses. Here are some typical comments:

Philadelphus coronarius — a sweet flowering shrub (call'd mock orange)

Clethra alnifolia — Flowers abundant in spikes, exceedingly sweet scented

Magnolia glauca — charming — the neat white roseate blossom possesses an animating fragrance.

Platanus orientalis—a famous tree celebrated for the beauty of his foliage, expansion, and grateful shade he affords.

Here is a list of some of the other species of trees, shrubs and vines Bartram then carried:

Norway maple (*Acer platanoides*)
Silver maple (*Acer saccharinum*)
Horse-chestnut (*Aesculus hippocastanum*)
Dutchman's pipe (*Aristolochia durior*)
Carolina allspice (*Calcycanthus floridus*)
Tatarian dogwood (*Cornus alba*)
Cornelian-cherry (*Cornus mas*)
American cyrilla (*Cyrilla racemiflora*)
February daphne (*Daphne mezereum*)
Dwarf fothergilla (*Fothergilla gardeni*)
Franklinia (*Franklinia alatamaha*)
Carolina silverbell (*Halesia carolina*)
Smooth hydrangea (*Hydrangea arborescens*)
Dahoon holly (*Ilex cassine*)
Goldenchain-tree (*Laburnum anagyroides*)
Sweet bay laurel (*Laurus nobilis*)
Coast leucothoë (*Leucothoë axillaris*)
Cucumber magnolia (*Magnolia acuminata*)
Umbrella magnolia (*Magnolia tripetala*)
Sweet mock-orange (*Philadelphus coronarius*)
Scentless mock-orange (*Philadelphus inodorus*)
Plane-tree (*Platanus orientalis*) (probably *P. × acerifolia*)
Cherry-laurel (*Prunus laurocerasus*)
Flowering peach (*Prunus persica*, double flowered)
Scarlet firethorn (*Pyracantha coccinea*)
Double-flowering pomegranate (*Punica granatum* 'Pleniflora')
Rosebay rhododendron (*Rhododendron maximum*)
European mountain-ash (*Sorbus aucuparia*)
Virginia stewartia (*Stewartia malacodendron*)
Big-leaf snowbell (*Styrax grandifolia*)
Persian lilac (*Syringa persica*) (*S. afghanica × laciniata*)
American arborvitae (*Thuja occidentalis*)
Oriental arborvitae (*Thuja orientalis*)
European cranberry-bush (*Viburnum opulus*)
Mound-lily yucca (*Yucca gloriosa*)

F. McG.

A "NEW" TREE IN 1888

IN horticulture as elsewhere, novelties of today are apt to be merely forgotten novelties of the past. This observation was made in a new magazine in 1888. In *Garden and Forest* it said: "A flowering dogwood with pink bracts [*Cornus florida rubra*] is now much talked of by nurserymen as something entirely new. But Mark Catesby, a century and a half ago, found 'one of these dogwood trees with flowers of a rose-color;' and the tree having 'luckily been blown down and many of its branches taking root,' he was able 'to transplant this variety into a garden.' This garden was in Virginia where Catesby lived for a time, and a colored plate showing the pink-flowered dogwood appeared in his work . . . which was published in 1731 after his return to England." This was Plate 27 in "Natural History of Carolina, Florida, and Bahamas."

Roche

Pink dogwood (*Cornus florida rubra*) whose deeply colored bracts become white at the base, is still uncommon in landscaping; but it was first made known to the horticultural world in 1731.

THOMAS MEEHAN, 19TH CENTURY PLANTSMAN

Self-educated scientific writer, editor, botanist and nurseryman

THOMAS MEEHAN (1826-1901), nurseryman, garden editor and botanist, was one of the great names in American horticulture in the latter part of the 19th century. Like many noted gardeners of the period, Meehan was born and trained in England. The family's resources were meager, and young Thomas became a gardener's assistant at 12 years of age. In the education he then imposed upon himself, he studied Greek, Latin, French and botany at night.

At the age of 15, Meehan became one of the first persons to hybridize the fuchsia, developing from *Fuchsia fulgens* × *F. longiflora* a plant he named 'St. Clare.' While still in his teens, he published several articles that recorded his scientific observations, one on the sensitive stamens of portulaca (*Portulaca grandiflora*), then a fairly new plant in England, and another on obtaining double-flowering stocks (*Mathiola incana*) from single-flowering ones. These were the first of several hundred scientific articles Meehan wrote.

At 19 Meehan undertook horticultural training at the Royal Botanic Gardens at Kew, on the outskirts of London. Here, his association with the Chartists, a radical political group of the time, led to the ill will of the then Director, Sir William Hooker, who promptly consigned the young gardener to duty in the cactus greenhouse. At the time it was considered a punishment post. In this stay Meehan learned as much as he could about cacti and, in later years, attributed Hooker's act of disfavor to his becoming a good friend of the naturalized American George Engelmann, a one-time world authority on cacti. Meehan took his assignments as they came, and finally received his Kew certificate.

In 1848, at 22, Meehan came to the United States with $25 in his pocket. After working a year at Buist's Nursery, a well-known Philadelphia firm, he served as gardener-superintendent for Andrew Eastwick, who then owned the John Bartram estate. He was made responsible for restoring the old garden to a semblance of its one-time glory.

In 1853 Meehan started a nursery company of his own in Ambler, Pennsylvania, a Philadelphia suburb, with a branch in Germantown. After a brief period of financial reverse during and after the Civil War, he reorganized the firm and it eventually became one of the best known nurseries in the United States.

Meehan's specialty was native American trees and shrubs, at the time surprisingly slighted by others. The nursery also concentrated on the Japanese snowball (*Viburnum plicatum*), a desirable replacement for the European snowball (*Viburnum opulus roseum*) because of its resistance to plant lice. At one time Meehan's snowball stock exceeded that of all other American and European nurseries combined. Meehan grew the original plant of the weeping dogwood (*Cornus florida pendula*). He also raised a wide variety of rare exotic trees. A descendent, J. Franklin Meehan, in the 1960's still operates the nursery at Center Square, Pennsylvania.

Meehan was a prolific writer and was known to serious gardeners also as editor of *The Gardener's Monthly* (1859-1888), later of *Meehan's Monthly* (1890-1901). The latter magazine was in part a vehicle to continue his outstanding series of articles, "The Flowers and Ferns of the United States". His "Handbook of Ornamental Trees" became a standard reference in the gardener's library. Meehan was also agricultural or horticultural editor of or contributor to publications in several eastern cities. Charles Darwin accepted Meehan's observations on natural history, and incorporated them—with due credit—in some of his books.

Meehan's most lasting works were achieved in his later years (1882-1901) as a city councilman in Philadelphia. He developed a plan under which the city would buy small areas of land to be used

(*Concluded on page* 85)

LIBERTY HYDE BAILEY

LIBERTY HYDE BAILEY (1858-1954) illuminated the American garden scene as have few men. Author of over 67 books, and editor-in-chief of the massive *Cyclopedia of American Horticulture* (4 volumes, 1900-1902, revised later in separate 6- and 3-volume editions), Bailey combined the best qualities of botanist and horticulturist at a time when plant scholars often had deep contempt for the practical benefits of botanical science. Bailey's horticultural-botanical work will undoubtedly be his lasting testimonial, and it is highly appropriate that successors carry on his fine work at the Hortorium* bearing his name at Cornell University in Ithaca, New York.

Less well known are the solid contributions Bailey (who had been reared on a farm in southern Michigan) made to improve the lot of rural America at the turn of this century. It started when, after a short apprenticeship sorting herbarium specimens for Asa Gray at Harvard University, he returned in 1885 to Michigan Agricultural College, to serve as Professor of Horticulture and Landscape Design. Then, as Professor of Horticulture (1889) and, later, as Dean of the College of Agriculture at Cornell (1903-1913), Bailey was a pioneer and chief spokesman in the extension service program, a uniquely American institution too often taken for granted in our materially comfortable times. Since farmers could not go to college, Bailey, in effect, brought college to them through a multitude of public information bulletins issued by his office. In addition, Bailey wrote a number of highly readable, lucid books on such directly useful subjects as vegetable and apple growing, grape culture, and pruning — all aimed toward the small rural landowner. It might be pointed out here that Bailey's *other* encyclopedia, *Cyclopedia of American Agriculture* (4 volumes, 1917) was a standard reference work in many country households.

Despite his many administrative tasks, Bailey was a familiar figure in the grange halls of New York and other states. His men sometimes journeyed in pairs to nearby farms to personally answer letter inquiries. While one worked the startled farmer's plough, so that the farmer might not lose precious work time, the other would straighten out the farmer's particular problem. Bailey often turned up himself to help farmers seeking information. In the early days of extension education, farmers frequently distrusted plant scientists, and Bailey, by such acts, helped break down this barrier to rural progress.

F. McG.

EARLY CATALOGUE LISTINGS FROM LONG ISLAND NURSERIES

(*Continued from page* 60)

HICKS

1878 Camperdown elm (*Ulmus glabra* 'Camperdownii')

1885 Weeping Higan cherry (*Prunus subhirtella pendula*)
Pissard plum (*Prunus cerasifera atropurpurea*)

1886 Schwedler maple (*Acer platanoides* 'Schwedleri')

1893 Japanese barberry (*Berberis thunbergii*)

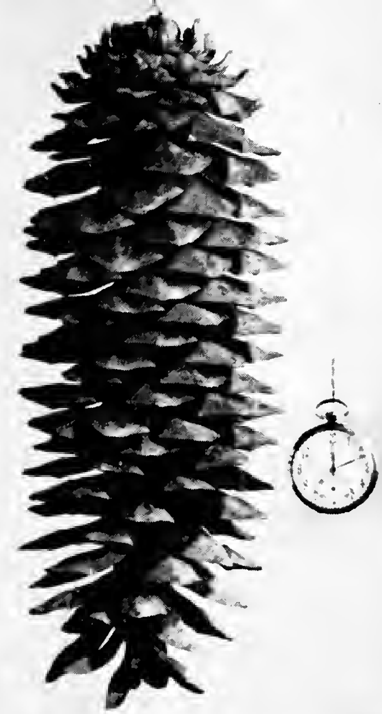
1895-97 Tea's weeping mulberry (*Morus alba pendula*) (catalogue undated)

1898 Amur privet (*Ligustrum amurense*)
Anthony Waterer spirea (*Spiraea* × *bumalda* 'Anthony Waterer')
Japanese holly (*Ilex crenata*)

* Hortorium. A word coined by Bailey to refer to a herbarium that includes plants of garden as well as of natural origin.

DISCOVERY OF SUGAR PINE

DAVID DOUGLAS (1799-1834), the Scottish plant explorer noted for his botanical discoveries in the Pacific Northwest of the United States, was responsible for bringing into cultivation some 215 kinds of plants. Strangely, he did not discover nor did he give the botanical name to the well known tree that bears his name—the Douglas-fir, *Pseudotsuga menziesii* (*P. taxifolia*). However, he was the first professional plant explorer to observe the remarkable sugar pine, *Pinus lambertiana*—a botanical name he gave the tree and which has lasted to this day. In his *Journal* he tells of the harrowing experiences he had in finding this tree:



Buhle

Cone of a sugar pine, which may be up to 20 inches long on a tree 250 feet tall. The sap is sweet.

Thursday, 26th.—Weather dull and cloudy. When my people in England are made acquainted with my travels, they may perhaps think I have told them nothing but my miseries. That may be very correct, but I now know that such objects as I am in quest of are not obtained without a share of labour, anxiety of mind, and sometimes risk of personal safety. I left my camp this morning at daylight on an excursion, leaving my guide to take care of the camp and horses until my return in the evening, when I found everything as I wished; in the interval he had dried my wet paper as I desired him. About an hour's walk from my camp I was met by an Indian, who on discovering me strung his bow and placed on his left arm a sleeve of racoon-skin and stood ready on the defence. As I was well convinced this was prompted through fear, he never before having seen such a being, I laid my gun at my feet on the ground and waved my hand for him to come to me, which he did with great caution. I made him place his bow and quiver beside my gun, and then struck a light and gave him to smoke and a few beads. With a pencil I made a rough sketch of the cone and pine I wanted and showed him it, when he instantly pointed to the hills about fifteen or twenty miles to the south. As I wanted to go in that direction, he seemingly with much good-will went with me. At midday I reached my long-wished *Pinus* (called by the Umpqua tribe *Natele*), and lost no time in examining and endeavouring to collect specimens and seeds. New or strange things seldom fail to make great impressions, and often at first we are liable to over-rate them; and lest I should never see my friends to tell them verbally of this most beautiful and immensely large tree, I now state the dimensions of the largest one I could find that was blown down by the wind: Three feet from the ground, 57 feet 9 inches in circumference; 134 feet from the ground, 17 feet 5 inches; extreme length, 215 feet. The trees are remarkably straight; bark uncommonly smooth for such large timber, of a whitish or light brown colour, and yields a great quantity of gum of a bright amber colour. The large trees are destitute of branches, generally for two-thirds the length of the

From David Douglas, *Journal Kept by David Douglas during His Travels in North America, 1823-1827* (London, 1914), pp. 229-231, as cited in Athelstan George Harvey, *Douglas of the Fir* (Cambridge: Harvard University Press, 1947), pp. 99-101.

tree; branches pendulous, and the cones hanging from their points like small sugar-loaves in a grocer's shop, it being only on the very largest trees that cones are seen, and the putting myself in possession of three cones (all I could) nearly brought my life to an end. Being unable to climb or hew down any, I took my gun and was busy clipping them from the branches with ball when eight Indians came at the report of my gun. They were all painted with red earth, armed with bows, arrows, spears of bone, and flint knives, and seemed to be anything but friendly. I endeavoured to explain to them what I wanted and they seemed satisfied and sat down to smoke, but had no sooner done so than I perceived one string his bow and another sharpen his flint knife with a pair of wooden pincers and hang it on the wrist of the right hand, which gave me ample testimony of their inclination. To save myself I could not do by flight, and without any hesitation I went backwards six paces and cocked my gun, and then pulled from my belt one of my pistols, which I held in my left hand. I was determined to fight for life. As I as much as possible endeavoured to preserve my coolness and perhaps did so, I stood eight or ten minutes looking at them and they at me without a word passing, till one at last, who seemed to be the leader, made a sign for tobacco, which I said they should get on condition of going and fetching me some cones. They went, and as soon as out of sight I picked up my three cones and a few twigs, and made a quick retreat to my camp, which I gained at dusk. The Indian who undertook to be my last guide I sent off, lest he should betray me. Wood of the pine fine, and very heavy; leaves short, in five, with a very short sheath bright green; cones, one 14½ inches long, one 14, and one 13½, and all containing fine seed. A little before this the cones are gathered by the Indians, roasted on the embers, quartered, and the seeds shaken out, which are then dried before the fire and pounded into a sort of flour, and sometimes eaten round [whole]. How irksome a night is to such a one as me under my circumstances! Cannot speak a word to my guide, not a book to read, constantly in expectation of an attack, and the position I am now in is lying on the grass with my gun beside me, writing by the light of my Columbian candle—namely a piece of wood containing rosin."

BROOKLYN'S FIRST BOTANIC GARDEN

BROOKLYN's first botanic garden was that of Andrew Parmentier (1780-1830), located on 25 acres of land near the present Long Island Railroad Station on Flatbush Avenue—less than a mile from the present Brooklyn Garden. Not a botanic garden in the sense we know today, Parmentier's establishment was a nursery along the same lines as Prince's Linnaean Botanic Garden in Flushing, Long Island.

Despite the short life of the nursery (1825-1832), it had some small claim to being a botanic garden. In 1829 Parmentier listed 242 varieties of apple trees, 190 of pear, 71 of cherry, 64 of peach, 15 of nectarine, 85 of plum, and 15 of apricot. He also offered 396 kinds of ornamental trees and shrubs, and over 200 varieties of roses, in addition to a number of greenhouse plants.

Parmentier, a Belgian native who arrived in New York only in 1824, came from a family with good botanical credentials. His brother was director of a large park in Enghein, Belgium, and a second cousin, Antoine Augustin Parmentier, is credited with popularizing the potato in France. To this day, French restaurants list potatoes *à la parmentière.*

F. McG.

See C. Stuart Gager in B.B.G. *Record*, Vol. 11, No. 4 (October 1922), pages 115—118. A rough map of Parmentier's nursery appears in the 1926 *Record* as well as a map of the same location with the present-day streets.

HALL—OF HALL'S HONEYSUCKLE

Frederick McGourty, Jr.

NO American plant hunter of the 19th century introduced as many important ornamental plants from the Orient as George Rogers Hall, M.D. (1820-1899). A native Rhode Islander and a graduate of Harvard University Medical School, Dr. Hall established a medical practice in Shanghai, China, in the late 1840's. He soon gave this up for trade, which he conducted successfully with Edward Cunningham, a lifelong friend and fellow New Englander who had also turned to the Orient. The two men journeyed in Cunningham's schooner, the *Halcyon*, to the various ports of call on the China Sea. On one occasion they were nearly killed by pirates. In 1855, before extensive trade with the West had begun, Hall and Cunningham made their first trip to Japan and apparently gained a considerable sum of money there by exchange of goods and currency. Hall collected numerous valuable art objects, which he took to America on his periodic trips. On one of his visits to Japan, Hall's interest was aroused in garden plants. In 1861, before leaving Japan for the United States, he delivered some plants, including a few kinds with variegated foliage (then in high fashion in American gardens), to F. Gordon Dexter, who was then returning to this country. Dexter, upon arrival, gave them to Francis Parkman, noted historian of the American Indian and an avid amateur horticulturist. The plants with variegated leaves, which included forms of the ginkgo (*Ginkgo biloba*), Japanese umbrella-pine (*Sciadopitys verticillata*), Japanese dogwood (*Cornus kousa*), and cryptomeria (*Cryptomeria japonica*), have largely been forgotten, but the following, also credited with being introduced to American horticulture for the first time, are well remembered: the gold-band lily (*Lilium auratum*), Parkman crab apple (*Malus halliana parkmanii*), and Hall's-amaryllis (*Lycoris squamigera*). The variegated form of the Japanese dogwood (*Cornus kousa*) was brought in before the species itself.

In late 1861 or early in the following year, Hall returned to the United States permanently. In March 1862 he delivered a large consignment of plants and seeds to the Parsons Nursery in Flushing, New York. It included the following, all of which were apparently first introductions:

Spider-leaf Japanese maple (*Acer palmatam ornatum*)
Scarlet Japanese maple (*Acer palmatum sanguineum*)
Aucuba (*Aucuba japonica*)
Hinoki false-cypress (*Chamaecyparis obtusa*)
Sawara false-cypress (*Chamaecyparis pisifera*)—10 garden forms
Plume cryptomeria (*Cryptomeria japonica elegans*)
Spreading euonymus (*Euonymus kiautschovicus*) (*E. patens*)
Peegee hydrangea (*Hydrangea paniculata grandiflora*)
Procumbent juniper (*Juniperus procumbens*)
Hall's honeysuckle (*Lonicera japonica halliana*)
Kobus magnolia (*Magnolia kobus*)
Star magnolia (*Magnolia stellata*)
Japanese red pine (*Pinus densiflora*)
Daimyo oak (*Qaercus dentata*)
Japanese umbrella-pine (*Sciadopitys verticillata*)
Dwarf Japanese yew (*Taxus cuspidata nana*)
Japanese wisteria (*Wisteria floribunda*)
Graybark-elm (*Zelkova serrata*)

Obviously, the former medical doctor had a sharp horticultural eye! It is remarkable that a man with no particular botanical background was responsible for so many notable plant introductions.* ◆

(*Continued from page* 81)

eventually as parks. In all, Meehan secured 23 new parks for the city. The most important purchase, in 1896, was the old John Bartram garden, which had suffered from neglect for some years. Although it is doubtful that any tree John Bartram planted remains alive today, in the 1960's, the Bartram garden still survives. ◆

F. McG.

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* An account of Dr. Hall's life and plant introductions, written by his grandson, James M. Howe, Jr., appeared in the *Journal of the Arnold Arboretum*, Vol. IV, No. 2 (April 1923), pp. 91-98. The title: "George Rogers Hall, Lover of Plants." The Hall estate in Bristol, Connecticut, is in existence today, with some of the originial plants still growing there.

The search for worth-while garden material undertaken by Longwood Gardens in collaboration with the Agricultural Research Service of the U.S.D.A. includes inspection of plants in continental botanic gardens. Here, Dr. Frederick G. Meyer is noting a specimen of *Picea abies procumbens* at the Gimborn Arboretum in The Netherlands.

A daisy known as South African capeweed (*Cryptostemma calendulacea*) has become naturalized near Coorow in western Australia. George Spalding, below, observed it there in 1958.

(*Continued from page* 55)

ations undertaken, together with names of the explorers, is as follows:

- 1956, Japan and Ryukyu Islands, J. L. Creech
- 1957, England and Southern Europe, F. G. Meyer
- 1958, Brazil, Llewelyn Williams
- 1958-59, Australia, George Spaulding
- 1959, Northern Europe, F. G. Meyer
- 1961 Japan and Hong Kong, J. L. Creech
- 1962, Nepal, J. L. Creech, F. DeVos
- 1962, USSR, J. L. Creech, D. H. Scott
- 1965, Northern India and Sikkim, F. DeVos, E. G. Corbett
- 1966, Korea and Japan, E. G. Corbett, R. Lighty
- 1967, Taiwan, J. L. Creech ◆

South America offers unrealized potential in new garden plants for North America and elsewhere. Llewelyn Williams is shown here as he examines a specimen of *Amaryllis* in the rain forest west of Corupá, State of Santa Catarina, in southern Brazil in 1958.

INTRODUCTORY DATES OF FAMILIAR TREES, SHRUBS AND VINES*

Trees

Colonial times
(no date)

Sycamore maple (*Acer pseudoplatanus*)
European white birch (*Betula pendula*)
European hornbeam (*Carpinus betulus*)
English hawthorn (*Crataegus oxyacantha*)
European beech (*Fagus sylvatica*)
European larch (*Larix decidua*)
Laurel (*Laurus nobilis*)
China-berry (*Melia azedarach*)
White mulberry (*Morus alba*)
Norway spruce (*Picea abies*)
Scotch pine (*Pinus sylvestris*)
London plane-tree (*Platanus* × *acerifolia*)
Pink double-flowered peach (*Prunus persica* 'Duplex')
English oak (*Quercus robur*)
English yew (*Taxus baccata*)
Little-leaf linden (*Tilia cordata*)

1576 Horse-chestnut (*Aesculus hippocastanum*)
1683 Cedar-of-Lebanon (*Cedrus libani*)
1730 Babylon weeping willow (*Salix babylonica*)
Before 1737 Oriental arborvitae (*Thuja orientalis*;
1745 Silk-tree (*Albizia julibrissin*)
1747 Crape-myrtle (*Lagerstroemia indica*)
1747 Scholar-tree (*Sophora japonica*)
1759 Austrian pine (*Pinus nigra*)
1762 Norway maple (*Acer platanoides*)
1763 Goldenrain-tree (*Koelreuteria paniculata*)
1767 Chinese juniper (*Juniperus chinensis*)
1784 Tree-of-heaven (*Ailanthus altissima*)
1784 Ginkgo (*Ginkgo biloba*)
1784 Lombardy poplar (*Populus nigra* 'Italica')
1789 Yulan magnolia (*Magnolia denudata*)
Before 1792 Cornelian-cherry (*Cornus mas*)
1794 Chinese elm (*Ulmus parvifolia*)
1795 Monkey-puzzle-tree (*Araucaria araucana*)
1820 Japanese maple (*Acer palmatum*)
Before 1832 Saucer magnolia (*Magnolia* × *soulangeana*)
1834 Empress-tree (*Paulownia tomentosa*)
Before 1840 Atlas cedar (*Cedrus atlantica*)
Beforo 1850 Smooth-leaved elm (*Ulmus carpinifolia*)
1854 Golden-larch (*Pseudolarix amabilis*)
1855 Japanese black pine (*Pinus thunbergii*)
About 1856 Amur cork-tree (*Phellodendron amurense*)
Beforo 1860 Japanese flowering cherry (*Prunus serrulata*)
1860 Siberian elm (*Ulmus pumila*)
About 1860 Graybark-elm (*Zelkova serrata*)
1861 Hinoki false-cypress (*Chamaecyparis obtusa*)
1861 Sawara false-cypress (*Chamaecyparis pisifera*)
1861 Cryptomeria (*Cryptomeria japonica*)
1862 Japanese crab apple (*Malus floribunda*)
About 1862 Weeping Higan cherry (*Prunus subhirtella pendula*)
1862 Japanese snowbell (*Styrax japonica*)
Before 1864 Waterer laburnum (*Laburnum* × *watereri*)
1865 Katsura-tree (*Cercidiphyllum japonicum*)

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* A selected list compiled primarily from Donald Wyman's "Trees for American Gardens" (Macmillan, New York. Revised and enlarged edition, 1965) and "Shrubs and Vines for American Gardens" (Macmillan, New York, 1956).

1874 Japanese stewartia (*Stewartia pseudo-camellia*)
1875 Japanese dogwood (*Cornus kousa*)
1876 Japanese tree lilac (*Syringa amurensis japonica*)
1888 Bechtel crab apple (*Malus ioensis plena*)
About 1890 Pissard plum (*Prunus cerasifera atropurpurea*)
1890 Sargent cherry (*Prunus sargentii*)
1892 Sargent crab apple (*Malus sargentii*)
1903 Chinese chestnut (*Castanea mollissima*)
1904 Dove-tree (*Davidia involucrata*)
1908 Callery pear (*Pyrus calleryana*)
1948 Metasequoia (*Metasequoia glyptostroboides*)
1953 Red Jade crab apple (*Malus* 'Red Jade')

Shrubs

Colonial times
(no date)

Common barberry (*Berberis vulgaris*)
Common box (*Buxus sempervirens*)
Heather (*Calluna vulgaris*)
Scotch broom (*Cytisus scoparius*)
February daphne (*Daphne mezereum*)
Russian-olive (*Elaeagnus angustifolia*)
Gardenia (*Gardenia jasminoides*)
English holly (*Ilex aquifolium*)
Common mock-orange (*Philadelphus coronarius*)
European snowball (*Viburnum opulus roseum*)

1576 Cherry-laurel (*Prunus laurocerasus*)
1588 Alpine currant (*Ribes alpinum*)
1620 Common lilac (*Syringa vulgaris*)
1629 Scarlet firethorn (*Pyracantha coccinea*)
1656 Smoke-bush (*Cotinus coggyria*)
1741 Siberian dogwood (*Cornus alba sibirica*)
1750 Chaste-tree (*Vitex agnus-castus*)
1752 Siberian pea-tree (*Caragana arborescens*)
1752 Rose daphne (*Daphne cneorum*)
1752 Tatarian honeysuckle (*Lonicera tatarica*)
About 1753 Persian lilac (*Syringa* × *persica*)
1763 Spring heath (*Erica carnea*)
1766 Wintersweet (*Chimonanthus praecox*)
1783 Gold-dust-tree (*Aucuba japonica variegata*)
Before 1790 Rose-of-sharon (*Hibiscus syriacus*)
1790 House hydrangea (*Hydrangea macrophylla*)
1797 Common camellia (*Camellia japonica*)
Before 1800 Flowering quince (*Chaenomeles speciosa*) (*C. lagenaria*)
1800 Tree peony (*Paeonia suffruticosa*)
1804 Evergreen euonymus (*Euonymus japonicus*)
1804 Nandina (*Nandina domestica*)
1805 Globe-flower (*Kerria japonica pleniflora*)
1814 Japanese snowball (*Viburnum plicatum*)
1824 Small-leaved cotoneaster (*Cotoneaster microphylla*)
1830 Thorny elaeagnus (*Elaeagnus pungens*)
1830 Autumn elaeagnus (*Elaeagnus umbellatus*)
1833 Siebold weeping forsythia (*Forsythia suspensa sieboldii*)
1835 Dwarf flowering-almond (*Prunus glandulosa*)
1838 Fatsia (*Fatsia japonica*)
1838 Indian azalea (*Rhododendron indicum*)
1838 Japanese skimmia (*Skimmia japonica*)
About 1840 Slender deutzia (*Deutzia gracilis*)
1843 Bridal-wreath spirea (*Spiraea prunifolia*)
About 1845 Rugosa rose (*Rosa rugosa*)
1845 Japanese beauty-berry (*Callicarpa japonica*)
1845 Rosy weigela (*Weigela florida*)
1846 Chinese holly (*Ilex cornuta*)
1847 California privet (*Ligustrum ovalifolium*)
Before 1850 Chinese redbud (*Cercis chinensis*)
1850 Chinese hibiscus (*Hibiscus rosa-sinensis*)
1850 Amoena azalea (*Rhododendron amoenum*)
1855 Flowering-almond (*Prunus triloba*)
1855 Japanese yew (*Taxus cuspidata*)
1856 Shrub bush-clover (*Lespedeza bicolor*)
1859 Five-leaf aralia (*Acanthopanax sieboldianus*)
About 1860 Little-leaf box (*Buxus microphylla*)
1860 Winged euonymus (*Euonymus alatus*)
1860 Amur privet (*Ligustrum amurense*)
1861 Japanese aucuba (*Aucuba japonica*)

1862 Peegee hydrangea (*Hydrangea paniculata grandiflora*)
1862 Star magnolia (*Magnolia stellata*)
1863 Thunberg spirea (*Spiraea thunbergii*)
1864 Japanese holly (*Ilex crenata*)
1865 Oriental photinia (*Photinia villosa*)
Before 1866 Vanhoutte spirea (*Spiraea* × *vanhouttei*)
About 1867 Warminster broom (*Cytisus* × *praecox*)
1868 Multiflora rose (*Rose multiflora*)
1870 Redvein enkianthus (*Enkianthus campanulatus*)
1870 Japanese pieris (*Pieris japonica*)
1875 Japanese barberry (*Berberis thunbergii*)
1875 Morrow honeysuckle (*Lonicera morrowii*)
1879 Chinese witch-hazel (*Hamamelis mollis*)
1880 Harlequin glory-bower (*Clerodendron trichotomum*)
About 1880 Rock-spray (*Cotoneaster horizontalis*)
1882 Japanese spurge (*Pachysandra terminalis*)
1883 Five-stamen tamarisk (*Tamarix pentandra*)
Before 1890 Ghent azalea (*Rhododendron* × *gandavense*)
About 1890 Common buddleia (*Buddleia davidii*)
1891 Memorial rose (*Rosa wichuraiana*)
1892 Torch azalea (*Rhododendron kaempferi*)
About 1897 Redbud pearl-bush (*Exochorda giraldii*)
1899 Father Hugo rose (*Rosa hugonis*)
About 1900 Anglo-Japanese yew (*Taxus* × *media*)
1900 Wintergreen barberry (*Berberis julianae*)
1900 Spreading cotoneaster (*Cotoneaster divaricata*)
1901 Pfitzer's juniper (*Juniperus* × *media* 'Pfitzeriana')
1901 Beauty-bush (*Kolkwitzia amabilis*)
1902 Korean-spice viburnum (*Viburnum carlesii*)
1904 Warty barberry (*Berberis verruculosa*)
1905 Fragrant winter-hazel (*Corylopsis glabrescens*)
1906 Showy border forsythia (*Forsythia* × *intermedia* 'Spectabilis'
1907 Virginal mock-orange (*Philadelphus* × *virginalis* 'Virginal')
About 1926 Compact winged euonymus (*Euonymus alatus compactus*)
1941 Arnold Dwarf forsythia (*Forsythia* 'Arnold Dwarf')

Vines

Colonial times
(no date)
Common white jasmine (*Jasminum officinale*)
1736 English ivy (*Hedera helix*)
1806 Japanese honeysuckle (*Lonicera japonica*)
1816 Chinese wisteria (*Wisteria sinensis*)
1945 Five-leaf akebia (*Akebia quinata*)
Before 1860 Hall's honeysuckle (*Lonicera japonica halliana*)
About 1860 Jackman clematis (*Clematis* × *jackmanii*)
1860 Oriental bittersweet (*Celastrus orbiculata*)
1862 Boston-ivy (*Parthenocissus tricuspidata*)
1864 Sweet autumn clematis (*Clematis dioscoreifolia robusta*) (*C. paniculata*)
1865 Climbing hydrangea (*Hydrangea petiolaris*)
1870 Porcelain ampelopsis (*Ampelopsis brevipedunculata*)
1876 Evergreen-bittersweet (*Euonymus fortunei vegetus*)
1885 Kudzu-vine (*Pueraria thunbergiana*)
1899 Silver fleece-vine (*Polygonum aubertii*)
1900 China-gooseberry (*Actinidia chinensis*)

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PLANTS & GARDENS

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CONTENTS

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Gabriel Moulin for the Save-the-Redwoods League

Redwood trees in National Tribute Grove, Jedediah Smith Redwoods State Park, California

It is with pleasure and pride that our Editorial Committee brings the twenty-third year of PLANTS & GARDENS to a close. Along with the stresses and strains of publication have come the joys and satisfactions of seeing ideas come to maturity, of knowing that what is at first in the minds of one or a few people will find its way to minds of many. It has always been and continues to be our hope that the lives of thoughtful readers will be just a little bit richer—because of the Brooklyn Botanic Garden.

All of which is to say that our Editorial committee is only a steering committee. It is the many talented people with gardening and horticultural interests—across the land—that make the PLANTS & GARDENS Handbooks possible. And once again it is a privilege to acknowledge their splendid work and their warm cooperation. For this particular year-end digest issue we also thank the editors and publishers of many journals for their help in producing this compendium.

The problem of the great redwoods (page 47) will seemingly never end. Our deep national interest in the preservation of significant natural things is the basic issue. And in those few hundred square miles of California countryside—mountains, hills and lush valleys—a special kind of heritage meets in fateful combat with modern economics. Yet, like many battles, it is fought away from the scene of greatest interest. Whether a meaningful solution can be found in our great national forum—the Halls of Congress—remains to be demonstrated. It is difficult to gain perspective on such a problem. Sober reflection tells us that the redwoods cannot live forever. Eons of time bring changes in the natural world. The great coal age forests, once as majestic as the redwoods, were long since reduced through earthen change to fossil blackness. They are now providing man with heat and power to support his complex urban life. It is the pace of contemporary life and Man's accelerated use of irreplaceable resources that present the great problem.

Had today's civilized man been on the earth at the time of the coal age forests, what might have been his role in the conservation of the great living trees of that epoch?

But coping with natural gardening on the scale of the redwood forests is beyond reach, so come back with us to the things we can do or will want to know about—for enriching our lives. The pages that follow are all concerned with messages about plants; please tune in—to learn and to enjoy.

George S. Avery

Director

P.S. A few good friends point out that we would do the Botanic Garden a service by not dating the issues—so apparent lateness would not matter. Were it not for Post Office rules we would like to do this—because the character of P & G is such that dating is relatively unimportant.

A GARDENER'S DECLARATION OF INDEPENDENCE

Methods used by English growers not necessarily applicable in the U.S.A.

R. Milton Carleton

Reprinted from GARDEN TALK, Chicago Horticultural Society, April-May 1967

NOW is the time American gardeners must declare independence from many practices established by their British counterparts. Although I yield to no one in my admiration for many of their gardening accomplishments, I have seen many failures here due directly to our faith in the methods used by our English gardening friends.

Problems with Perennials

Nowhere is this more conspicuous than in growing perennials from seed. Directions for this operation, copied from British texts without changing a word, have appeared in American gardening books for a century or more. As a result, failures with seeds of perennials are more common than are successes.

Lack of success with perennial seed is a more serious matter than it was a decade or so ago. One by one, our major producers of hardy plants are disappearing from commerce. Those that remain are plagued by shipping problems almost impossible to solve. As a result, unless perennials can be grown at home, many of them are just not available. Unfortunately, those that continue to be grown are usually the common, uninteresting sorts that good gardeners threw out years ago.

Climatic Contrasts

Before American gardeners can profit from their mistakes, an understanding of the important differences between England and the vast intermountain prairie that stretches from the foothills of the Rockies to the Alleghenies is needed. Ours is a truly continental climate, characterized by cold winters and hot, dry summers, with June night temperatures that reach the high 70's and low 80's. These affect not only the temperature range, but the moisture supply available for growing plants.

These seasonal extremes determine the type of plant material which can be grown, and affect the soils and other growth factors.

England, on the other hand, enjoys (or suffers) a truly maritime climate, swept in the growing season by moist, chilling winds, blown across 3,000 miles of the Atlantic. Even in July and August, night temperatures in the 50's are not unknown. If daytime readings rise to the high 70's, native Englishmen begin to complain about a "heat wave." In winter, on the other hand, temperatures are relatively mild. When an Englishman speaks in awe of 10 degrees of frost, he doesn't mean 10 above zero, but 10 below freezing, or 22 degrees.

These differences have a profound influence on the germination and growth of seeds, in particular those of perennial plants. In England, the gardeners need not think of sowing them until after the rush of spring work is over. This is a puttering job he reserves for late June and early July. In his cool soil, even a heat-intolerant species such as the delphinium germinates well and grows luxuriantly in July.

The difficulty is further compounded for American gardeners because most of

the perennials used in our gardens originated in England, or on parts of continental Europe subject to the same maritime influences. In France, even fruit trees are planted against stone walls to trap enough sun heat to ripen apples and pears. In the wild, seeds of perennials ripen in summer but may cling to the stalk until beaten to the ground by winter winds.

Built-in Mechanisms

Here they may imbibe or take up moisture, often through hard seed coats which need to be softened by exposure. Mechanisms in the seed, however, prevent them from germinating until suitable temperatures occur in nature. Many perennials need after-ripening at cool or even cold readings before these mechanisms can be overcome.

Victorian gardeners often soaked seeds overnight but this practice did not always result in improved growth. Soaking alone does not remove certain natural inhibitors from the seed which hold back germination.

Two chemicals commonly found in seeds are ferrulic and caffeic acids, which are soluble, but are removed only if the seed is washed after soaking. Since no perennial seed is injured by soaking over night, this practice is worth trying. In the morning, run tap water over the soaked seed, which will remove most of whatever inhibitors were present.

When we plant seed in warm soil in June, these built-in systems of control are circumvented and germination is either poor or does not occur. Even if the percentage of germination is high, sometimes the inherent element responsible for dormancy carries over and inhibits normal growth.

Seasonal Sunshine

Another factor responsible for failures in June is the quality of midsummer sunshine. At this season, the sun's rays are rich in blue, overbalancing the amount of red energy received by the plant. Since blue stimulates top growth at the expense of roots, root establishment is poorer than it is with seedlings which germinated in April and early May.

While the above conditions may sound complicated, the lesson to be learned from them is simple: sow perennials as early as the soil can be worked in spring. If conditions are unfavorable for digging, sow in flats and set the planted flats in the open. The sooner this can be done the better.

One particular British practice we can abandon is that of sowing delphinium seed only in late August, after the current season's crop has ripened. In the past, this was necessary to place the seed in contact with damp soil while it was still alive. If stored over winter, it lost vitality so rapidly that only 1% to 2% of the embryos would still be alive the following spring.

Saved by Refrigeration

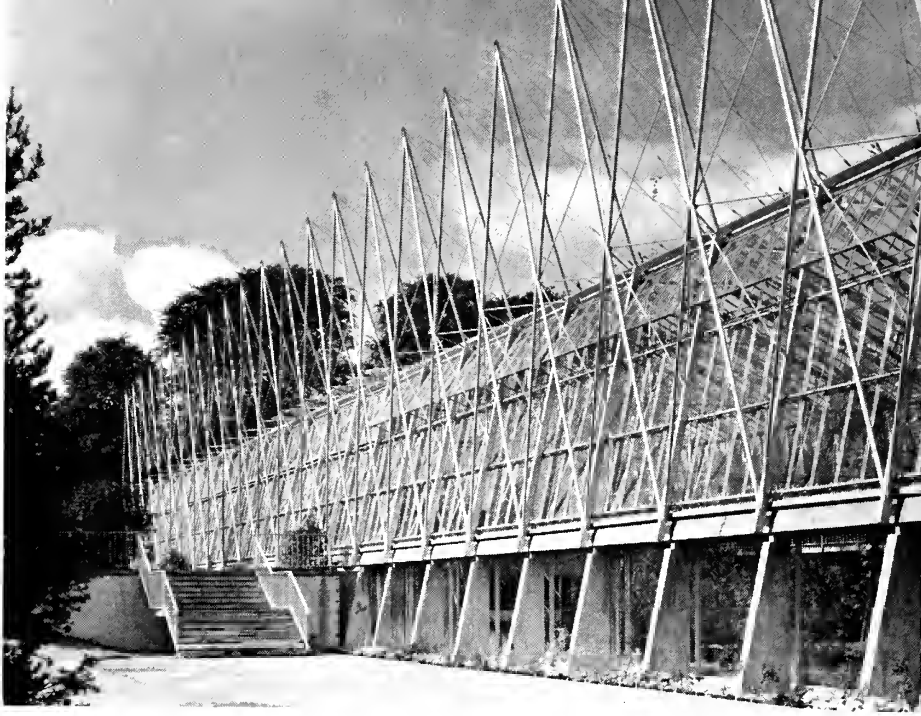
Nowadays, however, perishable seeds of this type are stored under refrigeration and retain their power of germination almost indefinitely. I have personally sown seed stored at below freezing temperatures for 13 years, which then germinated 50%.

Types of Light

One advantage to early sowing is that the seed need not be covered. It can be simply pressed into the damp surface where it will be exposed to sunlight. Many perennials will not germinate if covered, since orange-red light is needed to break down an inhibitor in the seed. This particular light must be close to 6,600 Angstroms, a wave length which does not penetrate too well into a thin covering of soil.

Its effect can be overcome by a dull red light called far-red, which is closer to the heat end of the spectrum and can punch through a fairly thick layer of soil. Only a short exposure to orange-red is needed, sometimes a matter of a minute or two, but unless that short exposure is given, the seed lies without sprouting. Once germination has been initiated, far-red has no effect.

(*Concluded on next page*)



Ministry of Public Buildings and Works

An inside-out type of construction has been devised for the new exhibition greenhouse at the Royal Botanic Garden in Edinburgh, Scotland. With all the supporting structure for the glass on the outside, the usual corrosion of glasshouse interiors does not take place. The new display house, 420 feet long, has five compartments, each with a different temperature and environment for the maintenance of exotic plants in natural settings. Paths wind informally through the plantings. The pool for tropical aquatics has a glass-walled viewing chamber underground.

(*Continued from preceding page*)

This eliminates the need for the lath or burlap shade so often recommended in American literature for growing perennials from seed. While such shading does overcome some of the temperature problems by keeping the seed cool, it also reduces the energy available to the seedling for growth following germination.

Soil and Fertilization

Another bit of folklore which we need to dispel is the oft-repeated recommendation that seedlings should not be sown in rich soil, which was supposed to cause soft, spindly growth. It is true that in the damp, cool climate of England, soil rich in decaying organic matter was a perfect incubator for the bacteria and fungi responsible for plant diseases. We must still avoid soils loaded with freshly-decaying plant wastes, but must not starve our seedlings to do it.

Research carried on since World War II has shown that the entire character of the plant—its vigor and health—are determined within the first two weeks of growth. If stunted during this period, it will carry that setback into maturity.

Ideal growing conditions are provided in a light, friable soil low in organic matter (unless this is thoroughly composted for a year or two). This soil should be watered regularly with a solution of chemical fertilizer. If a house plant fertilizer is used, dissolve this at one-fourth the rate recommended by the manufacturer on the package and use it every time the plants need watering. ♦

TREES FOR THE HOME LANDSCAPE

Alice Recknagel Ireys

TREES are the strongest structural element in your plan so it is important to select just the right ones and then to place them properly. . . . As you learn to recognize trees, you will find them a never-ending source of pleasure. Driving along a parkway in winter, you will be aware of the variety of forms, the pin oak with horizontal branches, the honey-locust stretching out to catch the winter light, the severely upright poplars, the graceful weeping willow, a cloud of gold from January on. Do discover the wide-spreading hawthorns with their bright red berries and the stratified sassafras growing in thickets and along the edge of the road. . . .

When you are thinking about trees for your place, try to answer these questions. What is their function here? Are they for a background or to frame the house? Do we want shade for the terrace or shadows on the lawn? Will grass grow under them? Are deciduous or evergreen trees more appropriate or do we need both? (Every year as the leaves fall, you will realize afresh the importance of evergreens.) What trees will be in good scale and fit well into our plan? Which trees will thrive here?

Keep referring to your plan. It plainly shows the important aspects of your house and grounds—how large the open area is, where shade or screen is needed. It may also indicate a telegraph pole you want to block out or a busy road to be concealed.

Before you buy a tree, be sure you know how large it will eventually grow, what form it will take—upright like the Lombardy poplar or cedar, oval like the sugar maple, drooping like the willow. Do you want a single or multiple-stemmed specimen? . . . Consider texture and color of foliage in summer and also in fall. Can you look forward to rich autumn hues? Think about how trees look in winter. Some have very interesting structures and color then, as the gray-trunked magnolias and the white birches.

Evergreens, usually slow growing and therefore longer in maturing, are essential for their good green winter color, their forms, their attraction for birds, and particularly for the character they give to a planting. . . . White pines normally grow faster than other evergreens and so are useful when quick screening is needed.

Do set out your trees so that there is room for them to develop without crowding. A 75 x 150-foot lot can accommodate but one shade tree and only two or three smaller flowering kinds. Plant the major trees with at least 30 feet between them, the smaller ones 15 feet apart. Too many trees soon crowd a small property. . . .

The type of root system, whether tap or fibrous, makes a difference in spacing and also in opportunity for planting underneath. Willows, Norway maples, and poplars have greedy roots close to the surface. Avoid these for lawn areas. Select instead for a large tree one of the oaks; their roots go deep into the soil, and ericaceous plants—azaleas, rhododendrons, and huckleberries—grow well under them. Perennial gardens can be developed under apple trees with beautiful spring pictures when the trees are in blossom and the early perennials bloom beneath them. Birch and crabapple are two deep-rooted smaller trees for lawns and gardens. . . .

Select at the nursery if at all possible and tag the best side of each tree so it can be planted to advantage on your property. ♦

Condensed from Chapter 5, "Trees and Their Associations," in "How to Plan and Plant Your Own Property," William Morrow & Co., New York, 1967. $7.95

PROPAGATION—IT'S IN THE BAG

Adapted from the BULLETIN of the Horticultural Society of New York, September 1967.*
Photographs by courtesy of the United States Department of Agriculture.

A SIMPLE and inexpensive method for rooting cuttings, already adopted on a large scale by many nurserymen and other specialists, can be easily employed by the home gardener: this is the use of plastic freezer bags. When properly carried out, this technique is able to provide the correct degree of light and humidity—in fact, the ideal environment—for the ready rooting of new cuttings.

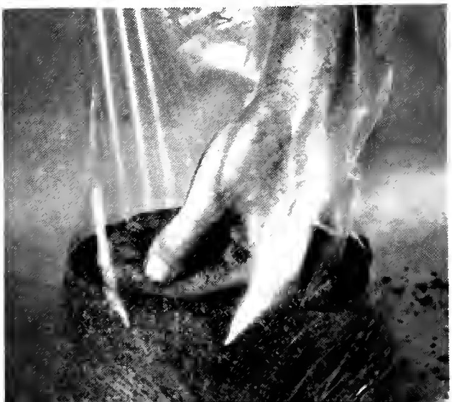
The photographs which follow illustrate the successive steps in the procedure. Sylvester March of the United States National Arboretum demonstrated the method to members of the Horticultural Society of New York in January 1967.

*In the same issue there is an article on other methods of plant propagation, entitled "Why Not Try It This Way?" by Mr. & Mrs. William Henry Hull, Jr. See also page 17.

◀ Ingredients for the rooting "soil" are two parts fibrous peatmoss and one part clean, washed sand, by volume. First, screen the peatmoss through a ¼-inch wire mesh to eliminate large particles.

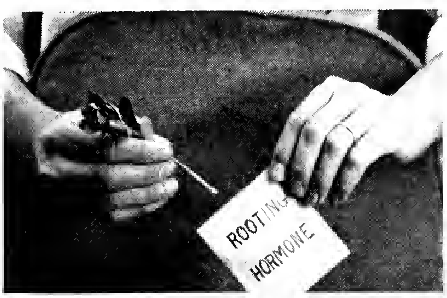
Then (*lower left*), mix thoroughly with sand, adding just enough water so that on squeezing some of the mixture, only a few drops will fall. It should not become mud-like.

Next (*below*), place this mixture to a depth of 4 to 5 inches in a 2-quart plastic freezer bag. Make it firm by pressing with the hand. (Make sure the bag is free of holes to prevent any moisture loss.)



Important to remember in this or any style of propagation is that cuttings must come from the current season's growth; they should have every evidence of freshness.

Take cuttings 4 to 6 inches long by applying pruning shears or a sharp knife straight across base. Remove leaves from lower half, which goes into rooting medium.



Before planting, take a very thin slice an inch long off one side of each cutting, ending it at the base. Dip this end in a rooting hormone (easily obtained at any garden supply center). This speeds root initiation.

With a pencil or stick somewhat larger than the stem, make a planting hole for each cutting. Insert the cutting (*as at right*) 2 to 3 inches deep, and press the sand and peat mixture around each one. Several cuttings may be rooted in the same bag if not crowded; but if their leaves overlap they do not get sufficient light and the specimens may rot.

Cuttings should be sprinkled only enough to wet the foliage, not watered again until roots are well established.

The top of the miniature plastic "greenhouse" can now be tightly sealed. This will prevent loss of moisture.

Cuttings will generally root in eight to ten weeks, although the period will vary with each species. Open the bag after 60 days and gently remove a cutting—if roots ½ to 1 inch long have formed, the cutting is ready to be transferred to a pot. It is generally advisable to prepare the material for the drier atmosphere of the home by gradually opening the bag over a one-week period. Occasionally add water to offset any loss of moisture through evaporation during this period. Some cuttings may take longer—these should be reinserted in the medium and checked again after two weeks. Those which show signs of decay should be immediately discarded.

Many ornamentals can be propagated successfully in this manner. Following is a chart for recommended rooting times:

Conifers, such as yew and juniper—January and early February.

Garden flowers, including geraniums, lantana, and roses—late May through August.

Flowering shrubs, such as forsythia, mock-orange, and viburnum—mid-June to mid-August.

Broadleaved evergreens (holly, azaleas and camellias)—mid-June to mid-August.

Indoor foliage plants, including ivy, philodendron, and Chinese evergreen—any time of the year. ♦

The plastic bag of cuttings should receive full light but NO direct sun.

FORMATION OF SOIL IS SPEEDED BY PLANTS

Brij L. Sawhney

Reprinted from FRONTIERS OF PLANT SCIENCE, The Connecticut Agricultural Experiment Station, New Haven, Conn., November 1967

THE weathering of rocks creates tiny clay particles. Each particle may consist of several hundred mica plates, so small that they can be identified only by electrons or X rays. Plants not only feed upon the nutrients stored on the clays but also change the clays of the soil.

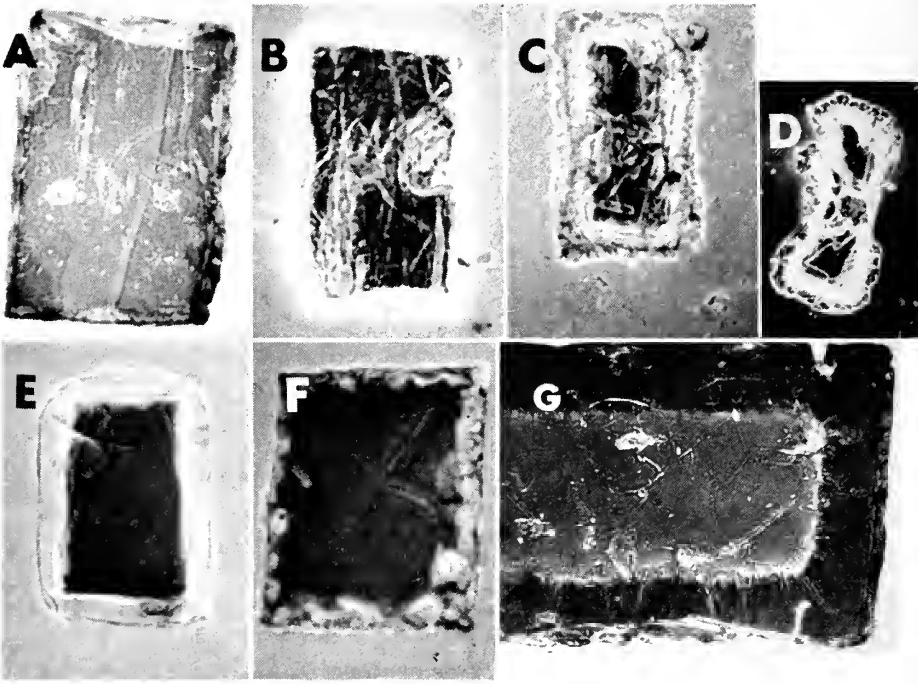
THE soil mantle of the earth provides a vast and changing spectacle which we cannot resist investigating. In addition, the soil is our principal means of sustenance. This lends importance and even urgency to learning how plants feed upon the soil and how the soil is changed by their feeding.

Of the mineral components in the soil, clay is the most important because it stores most of the plant nutrients and holds much of the water. In Connecticut, this clay is predominantly vermiculite that is formed by the weathering and expansion of mica in the bedrock. A small speck of unweathered mica may contain several thousand mica units, each consisting of a layer of alumina sandwiched between two layers of silica. These units are negatively charged and have cavities in their surfaces. Positively-charged potassium ions fit into these cavities, and hold the units together in a mica particle.

When the mica is weathered, the potassium ions are replaced by hydrated ions such as calcium, and the negative charge on its surfaces is decreased by several chemical changes including the oxidation of its iron. Consequently, the mica units are held together less tightly than before and become the expanded vermiculite lattice of our clay. These alterations give the clay the important property of ion exchange. Biologically, this new property is of great importance: a storage site for nutrients is created. The nutrient elements, such as calcium, reside on the exchange sites of the clay and can be taken up by plants. At the same time, they are retained tightly enough to prevent their loss by leaching through the soil profile.

In order to understand this course of weathering, the investigator tries to simulate the process in his laboratory. Several investigators have weathered mica to vermiculite by leaching mica with solutions of calcium or magnesium salts or by treating mica with chemicals which extract potassium from the interlayers of mica. In the field, biotite (a form of mica) has been changed to vermiculite by growing crops of wheat upon it.

Our soil in Connecticut is acid, however, and most of it grows trees. Since a large portion of the potassium for feeding the trees comes from mica, an understanding of the weathering of mica by trees is particularly important. Furthermore, in some forested acid soils, a bleached zone containing amorphous or noncrystalline clay is known to develop beneath the forest litter. (Such soils occupy vast acreages of land throughout the world and are known by their Russian



Effects of different weathering agents on chips of mica in the soil. A—in oxalic acid; B, C and D—progressive stages after one, two and three weeks. E—after eight weeks in the presence of a fungus; F—inoculated with a certain soil. G—in a salt solution. The mica flakes average .5 mm. in diameter.

name, podzols.) As tree growth is affected by such soils, so is the formation of these soils affected by the trees.

For these reasons, J. R. Boyle and G. K. Voigt, of the Yale School of Forestry, and I investigated the weathering of biotite mica by roots of tree seedlings and associated micro-organisms. We also studied the effect upon mica of the organic acids which are released either from the living tree roots or from decaying trees. We found that mica weathered much differently in these acid environs than in salt solutions or in the neighborhood of wheat roots and their associated micro-organisms.

The dramatic differences shown by the different weathering agents is one of the most pleasing outcomes of this investigation. These can be seen in the photographs. When the original flake shown in Fig. A is placed in an organic acid, the weathering produces a translucent band along the edges of the flake as seen in Fig. B. The weathering band advances and eventually covers most of the flake; photographs B, C, and D show the changes in the same flake after one, two, and three weeks in one molar oxalic acid. Similar but slower advance of the translucent band was produced by *Aspergillus niger*, a fungus, growing in an 8% glucose solution, Fig. E, or by a solution inoculated with a suspension of soil from a tulip-poplar stand, Fig. F. Both E and F show flakes after eight weeks' weathering.

This is strikingly different from the weathering caused by salt solutions or by wheat. When placed in salts, the band of

(*Concluded on next page*)

NEW LEADS REPORTED ON INSECT CONTROL

THREE new approaches to insect control were presented in papers delivered by scientists of the Connecticut Agricultural Experiment Station at the annual meeting of the Eastern Branch, Entomological Society of America, in Baltimore, October 30 and 31, 1967.

Toxin from a Mold

Fly larvae, mosquito larvae and milkweed bug nymphs, according to reports by Drs. R. L. Beard and G. S. Walton, have been affected by a toxin derived from a mold, *Aspergillus flavus*. The toxin kills slowly, but less than lethal concentrations may retard development. Surviving house flies may be miniature but otherwise apparently normal.

Effect of Colored Lights

Using black bean aphids as test insects in flight chamber experiments, Dr. James B. Kring found that winged aphids responded to colored fluorescent lights. Although these aphids are known to be attracted to yellow surfaces, their response to colored light is quite different. Dr. Kring attributes this difference to the ultraviolet output of the lamps, which seems to override color as an attractant. A blacklight lamp was found to be most attractive, followed by blue, cool green, pink, green, gold and red. The least attractive gold and red lamps reduced activity of the aphids. Blacklight increased activity.

Temptations for Apple Maggots

Dr. Ronald J. Prokopy reported on attraction of apple maggot flies to objects of various colors, shapes, and sizes. Yellow was the most attractive color when presented as 12- by 16-inch painted rectangles or 12- and 18-inch spheres. It was the least attractive color when used on a sphere about the size of an apple (3 inches). Red, blue, violet and black were the most attractive colors when displayed as 3-inch spheres. Of all the colors, shapes, and sizes tested, 3-inch spheres of these colors attracted more apple maggot flies than did any other objects. ◆

FORMATION OF SOIL

(*Continued from preceding page*)

weathering, Fig. G, is a dark one rather than transparent or translucent.

The darkening of the band by salt solutions has been attributed to the replacement of the potassium between the mica layers of the hydrated cation of the salt. The translucent band produced by the acids and seen in the photographs is attributed, on the other hand, to the removal of iron and magnesium from ***within*** the mica crystal. The organic acids extract iron, magnesium, and aluminum, leaving behind a fragile silica matrix seen as the translucent band. This silica matrix disintegrates easily and the mica structure collapses.

An examination by X rays of the products of weathering confirmed what could be seen in the pictures. Weathering by salt solutions expanded the mica units from 10 to 14 angstroms. But weathering by organic acids and by solutions growing micro-organisms destroyed the original, regular structure of the mica and left only an amorphous residue. Apparently, weathering of micaceous minerals by micro-organisms and acids is responsible for the bleached zone containing amorphous clay in the podzols of the cool forest. Thus, the organic substances from tree roots and the associated micro-organisms play an important role in the weathering of bedrock and the forming of our soils. ◆

DWARF SHRUBS OF DISTINCTION

Donald G. Allen

Condensed and adapted from FLOWER AND GARDEN, October 1967

*SHRUBS that remain small in size have many uses in home landscapes, and they have, in addition, qualities of beauty, permanence, reliability and easy maintenance. They can be combined with larger shrubs for contrast in height and form, or used as highlights in a garden of miniature plants. Many can serve as flowery groundcovers. Evergreen kinds are particularly useful for edging a patio or a path. In rock gardens they are indispensable. Illustrated here are a few of the finest.**

*For information on where to obtain about 90 different kinds, send a stamped, addressed envelope to *Flower and Garden Magazine*, BR-69, 4251 Pennsylvania, Kansas City, Missouri 64111.

Taloumis

Kingsville boxwood (*Buxus microphylla compacta*) is reasonably hardy and has the tailored appearance desirable in a formal edging to a walk.

Scotch heather (*Calluna vulgaris*) does best in a cool climate but one without blustery winters. Many distinctive varieties are available.

Roche

Roche

Most of the heaths require warmer regions than the heathers. The cross heath (*Erica tetralix*) shown here is the less tender variety *alba*.

Cotoneaster horizontalis is deciduous in northern climates. It will make a low dome or fan out over a rock to display its flowers and fruits.

Taloumis

BRING 'EM BACK ALIVE

—And within the law

Peggie Schulz

Reprinted from FLOWER AND GARDEN, June 1967

HALF the fun of many gardeners' vacations lies in bringing back new cuttings and plants to add to their collections. But it's no fun to collect plant treasures, then have them ruined in transit. By using a little foresight instead of hindsight you can bring them back alive through heat or cold no matter how many miles you travel.

Plants such as cacti and other succulents, bromeliads and most orchids are good travelers, especially during warm weather, and need little further protection than paper wrapping. Others such as African-violets, begonias, impatiens and many miniatures need special attention to arrive home in tiptop condition.

Guides for Wild Plants

If you plan to bring back wild plants from woods or field obtain a listing of the protected plants of the area, so you know what NOT to dig. You can get such a list from the Conservation Department of each state. A fine book that lists protected plants in all states is *National Plant Conservation,* compiled by Ethel Magwood Burns (available from National Council Books, Inc., Box 4965, Philadelphia, Pa. 19119. $2.00).

Other rules concerning transporting plants or cuttings of citrus, cotton and related plants vary from one state to another. Check with your State Agricultural Department, Plant Quarantine Division for specific regulations. In California, for example, established nurseries and greenhouses will tag purchased plants with a clean bill of health so they will pass most states' border inspection.

The containers you take to transport plants will depend on the type of plants you collect and the space you can allow them. Plastic bags, refrigerator dishes, labels, white adhesive tape, marking pencil, and small jars of rooting hormone and fungicide (Fermate or similar kind) are great aids. Straight-sided dishes or tubs are space savers.

Replant wild plants as soon as possible in a container of soil and leaf mold taken from their growing area. Prepare their permanent growing spot in a garden section where conditions are like those in their natural habitat. Do this before you leave home, if you know what it is you'll be collecting.

Potted Plant Precautions

If you collect tender potted plants, add some drainage material such as pot chips, pebbles or charcoal to the bottom of a plastic or metal box or other container. Then add two inches of vermiculite or other lightweight inorganic material. Sink the potted plants into the container, cover with a sheet of polyethylene film and they'll travel safely. Keep the carrier out of direct sun to ward off leaf burn. When carrying large-crowned plants such as some African-violets and gloxinias, lodge a ring of twisted paper or a cardboard collar under the outer leaves to prevent leaf breakage.

Give added protection to miniatures such as *Sinningia pusilla* (miniature gloxinia) and some of the tiny geraniums by criss-crossing the top of the pot close to the plant with two pieces of adhesive tape, fastening them to the pot edges.

Back-seat Stand for Plants

If you are traveling in an uncrowded car consider a plywood stand to hold mature plants. To make the stand you will need two pieces of plywood—one as

large as the back seat cushion plus the distance between cushion and back of the front seat, the other piece to reach from the car floor to the top of the first piece of wood. Nail or glue (or both) the second piece (the floor support) to the outer edge of the first piece. Use a coping or saber saw to cut out 2- to 1-inch rounds in the upper piece so pots slip in easily and ride securely. Paper packed between plants will cushion them against breakage; a plastic bag slipped over each plant will aid in moisture retention. I've seen dozens of flower-laden plants carried from east to west coast in this way. They arrived in fine fettle and made beautiful show displays.

Any time that plastic film or covers show beads of moisture, remove them and wipe them dry before replacing them.

If nights are cold bring plant containers into your sleeping quarters. Uncover plants, inspect for rot or broken leaves, and need of watering. If any parts show rot, cut back to firm tissue, dust cut areas with fungicide, then withhold water a few days until the condition clears up.

Ways to Transport Cuttings

There are many simple ways to transport leaves and small cuttings. If you are cramped for space or are traveling via public carrier, plastic bags will be the easiest way to safeguard your material. Slip any kind of plant material into a bag, insert a label, then close the bag with a rubber band. No moisture-producing material is needed, for the bag will hold in plenty of moisture.

If you are traveling only two or three days and do not have plastic bags with you, stick the end of a cutting into a piece of wet cotton or even several thicknesses of wet paper, and wrap the cutting in dry paper. It should arrive in good shape.

To transport several cuttings in the smallest space, cut a piece of plastic film 8 inches wide by 12 to 18 inches long. Lay the plastic flat and place a half-inch band of moistened sphagnum or peatmoss across the center. Lay the cuttings on the moss, cover the ends with a thin layer of moistened moss. Fold the bottom edge of the plastic over the cuttings. Fasten top edges with staples or clips. Roll the plastic as you would a jelly roll and you'll have a "cutting roll" small enough to carry in your purse or pocket.

On an extended trip, the best way to treat cuttings is to dip ends in rooting hormone and plant them into a plastic box of non-organic rooting medium. Set the planting where it receives filtered light. The floor of the car makes a good riding area. Cuttings treated this way may be rooted when you arrive home.

At home, isolate the new plant material for a few weeks before including it with established collections. This gives you a chance to check for possible ailments and pests which new plants might harbor.

It is not difficult to bring home live plant material and it's fun to have a vacation. ♦

SMUGGLERS CAUGHT

AGRICULTURAL quarantine inspectors of USDA's Agricultural Research Service have the important task of keeping destructive foreign plant and animal pests and diseases out of the U.S.A.

Inevitably, a few travelers try to smuggle prohibited materials. At the Mexican border, a woman calmly nibbled a sandwich while inspectors discovered 20 undeclared fruits and plant cuttings concealed in her luggage. Then, thoroughly suspicious, inspectors took a closer look at the "sandwich," and found two more plant cuttings and two bags of seeds placed neatly between bread slices.

The youngest "smuggler" of the year was intercepted at Miami, Fla. An alert inspector noticed that a 2½-month-old baby looked uncomfortable in its bassinet. Wondering why, he investigated and found three prohibited avocados hidden among the bedclothes. Avocados often contain larvae of the avocado seed moth, a serious pest in Latin America. ♦

PROPAGATING SPECIAL FORMS OF CANADIAN HEMLOCK

Harold Epstein

Reprinted from the BULLETIN of the Horticultural Society of New York, September 1967

Author photo

Twenty-five-year-old plant of *Tsuga canadensis prostrata* growing beside a rock. (Available from numerous dwarf plant nurseries as Cole's Prostrate Hemlock.)

THE graceful eastern conifer known as the Canadian hemlock *Tsuga canadensis*), which has proved so useful an evergreen in a variety of positions in our landscapes, has usually been propagated from seed, especially when a large number of plants is required. During the past score of years considerable interest has been aroused in propagating many variants of the more distinctive and interesting forms. Most of these are of dwarf, compact, spreading, or procumbent form, often with foliage variations also. While there has been interest in different forms of other conifer genera, both here and abroad, only in recent years have European nursery and arboretum lists begun to list Canadian hemlock varieties and to offer plants for sale.

Over one hundred mutants of the type species have now been introduced. It is interesting to note that there are only three forms that have been reported as being derived from "witches'-brooms," (the term used for the curious nest-like growth conglomerations that occur on some trees). These growths may arise either from insect irritation, parasitic fungi, or some constriction of sap or growth—the subject is by no means clear. The vast majority of hemlock variations or mutations have occurred among natural stands, often in nursery seed beds. I have in mind only natural variants, not the artificial dwarfs created by the Japanese and Chinese and known as bonsai.

In order to propagate some of these interesting and desirable forms of hemlock and retain their identical form and habit, it is necessary to create new plants

vegetatively. Surprisingly, it is generally much easier to propagate most hemlock mutants than the type-species itself.

Grafting

One of the alternative methods of vegetative propagation is grafting small sections of a plant or seedlings of *Tsuga canadensis*. This is now not generally recommended, although many nurserymen still follow the practice in order to produce economically a larger plant in a shorter time. The result is often a plant not strictly identical to the parent, for the growth may be more vigorous, inducing a loss of the true form and character. (There is also the risk that growth from the understock may overwhelm the grafted top growth.)

Layering

A second means of vegetative propagation is by layering, particularly if the plant habit permits pegging small branches down to the soil. This is a simple way to increase a plant where only a small quantity of propagations are desired. Several variations of the following procedure are possible. First, determine the point at which the branch can be pegged down to the soil level. At that point, carefully remove foliage and slightly scar the underpart of the branch where it will be covered with soil. Several inches of the terminal should protrude from the soil. This small area should have some gritty sand and peatmoss mixed in, in order to induce formation of roots. Stimulation of rooting may be also encouraged by treating the scarred branch with some hormone, such as Hormodin #2 or #3. The branch may be firmly pegged to the soil by use of hairpins, clothespins, a forked twig, or be weighted with a stone. This procedure will usually produce a well rooted plant in from six months to two years. After a substantial root system is produced, the branch is then severed and preferably potted for a period of establishment. The branch tip being layered should be one- or two-year-old wood, and the timing should be from midsummer to autumn.

Air-layering

Air-layering is another alternative propagating method. But perhaps the most desirable means of propagating hemlock mutants is by the rooting of cuttings. Methods vary, depending upon the objective of several plants or hundreds. Plants that develop their own roots are usually more stable and more nearly identical to the parent, although an occasional variant is likely to be produced. The following is a brief reminder list of pertinent facts concerning the rooting of mutant hemlock cuttings:

Rooting of Cuttings

Cutting Age. While it is possible to root many varieties from one-, two-, or three-year-old wood, two-year-old cuttings are generally the most desirable. They produce a more substantial plant than younger cuttings. (In some of the extremely dwarf and slow growers, like *T. canadensis* var. *minuta*, a one-year cutting would only be about a half-inch tall—a size rather difficult to handle and guard.) Cuttings can be taken from late July until midwinter, the earlier period being recommended for the amateur with limited facilities.

Rooting Medium. A good general rooting mixture is 60 per cent by volume of clean, gritty sand, and 4 per cent sphagnum peatmoss that is not too fine and dusty. There are many other possible variations of materials and mixtures, common ones containing perlite, vermiculite, and screened fresh or dried sphagnum.

Containers. The rooting mixture may be used in clay or plastic pots or pans. Or, if a larger quantity of cuttings is desired, a substantial wood, plastic, or metal flat may be used. In either case, the container should be drained with plenty of pot pieces, so that there cannot possibly be any stagnant condition.

Cutting Treatment. It is impossible to be specific about the proper size of a hemlock cutting. Its length is entirely dependent upon the rate of growth of the plant and the length of stem available. The dwarf varieties will produce very

little cutting material until the plant has made several years' growth. In any case, cuttings should be severed by a sharp tool. In order to induce roots on the side as well as the base of a cutting, scarring is suggested on the side after the basal leaves have been carefully removed. It is most important to minimize the time between making the cutting and planting it. On hot, dry days, the loss of moisture from cuttings can be damaging and even fatal. Moisture loss can be controlled by immediately placing cuttings, when first removed from the parent plant, into a polyethylene bag, which should be kept closed until cuttings are inserted in the rooting mixture. Or, wrap the cuttings in wet burlap, even newspaper, and spray with water occasionally. The rooting mixture should have been previously thoroughly watered, so that the cuttings are easily inserted and spaced. Although not essential, you can speed root formation by the use of hormones in either powder or liquid form (perhaps the most popular material for hemlocks, as well as other conifers and most woody plants, is Hormodin #3, which has added to it a small quantity of a fungicide such as Captan). Dip the prepared cuttings prior to insertion in the rooting medium. Finally, the cuttings should be thoroughly watered to firm them in the mix.

Cutting Position. The major objective, then, is to reduce to a minimum the transpiration (moisture loss) of the cuttings. The simplest method is to enclose the container, pot or flat, with polyethylene. If a flat or pot is used, a framework of wire should be built above the cuttings, so that there is no loss of humidity from this miniature greenhouse. Utilizing this enclosed chamber technique will require a minimum of watering and attention. These containers (after being well marked or labeled with contents and date) may then be placed in a protected area or coldframe on the north side of a house, so that the cuttings receive full light but not sunshine. They may remain in a covered coldframe all winter.

There are more elaborate means of propagation of such cuttings where a greenhouse is available. The use of controlled bottom heat plus intermittent mist activated by a time clock will assist materially in producing larger quantities and faster results. Or, intermittent mist and outdoors in full sun will also assist the rooting action.

Author photo

A group of the prostrate variety of Canadian hemlock with one trained upright. These plants are 18 years old from cuttings. (*In the background:* a white form of *Lilium auratum* and, directly behind the hemlocks, a dwarf form of *Rhododendron keiskei.*)

Cleanliness is a major factor in successful propagation. Use clean cuttings and tools, and eliminate all chance of fungus infection in the cutting container. With average care and attention, a high percentage of cuttings will root—but be patient, for some varieties will require six months or more to establish, whereas others may root in half the time. ♦

THE BOYCE THOMPSON SOUTHWESTERN ARBORETUM

Thelma Taylor

THE Boyce Thompson Southwestern Arboretum in Superior, Arizona, considered one of the world's most unusual gardens since its origin in 1925, is currently operated as part of the University of Arizona's Desert Biology Station, and is envisioned as playing an important role in the University's acceleration of a long-established program in desert biology research.

The Desert Biology Station, founded through an agreement between the University of Arizona at Tucson and the Boyce Thompson Southwestern Arboretum Board, is designed to serve a threefold educational function: (1) to keep the Arboretum open as a public education facility concerned with desert plants of both the Old and New Worlds; (2) to create a research center for biologists who are interested in the desert, and (3) to provide a training center for advanced students in the biological sciences.

The Arboretum is readily accessible to visitors, for it is only 65 miles east of Phoenix, Arizona, on U. S. Highway 60-70, in the heart of the Southwestern United States. Located in the northern part of the Arizona Desert, it lies in the foothills of the Pinal Mountains, in the Tonto National Forest.

The Arizona Desert, which is that portion of the Upper Sonoran Desert east of the Colorado River and lower Gila River drainages, has an abundance of arboreal and succulent plants which are lacking in other deserts of the Southwest. One such plant, the saguaro (*Carnegiea gigantea*), attains its maximum size and population densities here. Associates of the saguaro are the palo verde(*Cercidium floridum*), desert ironwood (*Olneya tesota*), and mesquite (*Prosopis* species) trees, besides numerous shrubs from the legume and sunflower families, and a host of cacti.

Shrubby members of the lily and amaryllis families—*Yucca, Agave,* beargrass (*Nolina microcarpa*) and sotol (*Dasylirion wheeleri*)—thrive along with the leguminous acacias and mimosas, while in other parts the creosote-bush (*Larrea tridentata*) dominates the landscape. In the major canyons and washes of higher mountains along the eastern and northern borders of the Arizona Desert, mixed groves of trees containing Arizona sycamore (*Platanus wrightii*), Arizona ash of several kinds (*Fraxinus* species), Fremont cottonwood (*Populus fremontii*) and Arizona walnut (*Juglans major*) are predominant.

Approximately 300 acres of the land in the Arboretum are under patent, while 800 acres are leased from the United States Forest Service. About 28 acres are devoted to the Arboretum proper, with plants from arid and sub-arid regions throughout the world mingling with the natives to enhance the natural beauty of this unique garden which thousands visit yearly.

The Arboretum was incorporated under the laws of Arizona through a special legislative act in March, 1925, and the original aim for it was to bring together plants of the drier climates, and grow them for study and possible utilization in the Southwest.

Conceived by the copper mining magnate, the late Colonel William Boyce Thompson (founder also of the Boyce Thompson Institute for Plant Research in Yonkers, New York) the Arboretum came into existence through his love for the West, his feeling that there was need for more attention to the plants of arid areas, and his strong aversion to the careless destruction of vegetation. He believed that conservation and proper utilization of plant resources were the responsibility of every person.

Plants were immediately introduced

Drawings (adapted from author photos) by Eva Melady

In the Boyce Thompson Southwestern Arboretum, Superior, Arizona

into the Arboretum from desert regions of Australia, Japan, China, Africa, Italy, and other parts of the world. Among the early introductions were bottle-brush trees (*Callistemon* and *Melaleuca*), several of *Eucalyptus,* and cypress-pine (*Callitris*), all from Australia, with a date palm (*Phoenix canariensis*) from the Canary Islands, and the boojum (upside-down) tree (*Idria columnaris*) from Baja California. All gave proof of adaptability to local conditions. New plants are still being brought in to test for their adaptability, environment response, hardiness and utility.

Fulfilling the function of research and training center in the biological sciences, the Desert Biology Station is the site for a number of research projects currently in progress. Others have been completed, and more are in the development stage for future studies.

Among those completed and in progress are a study of the effects of overcrowding on behavior, territory and home ranges of small desert animals; a study on seasonal fluctuation in the bird population of the region, and studies in herpetology.

Varied field courses are offered every summer to advanced students in the biological sciences, and accommodations are available on a limited basis for biologists on individual projects throughout the year. Classes from other universities and colleges come in for courses in the biological sciences, and individuals from other areas in the country utilize the facility in their research in different fields.

A library is housed in the administration building, offering books, journals, reprints, bulletins and circulars, among other publications, mainly botanical in nature, for use by anyone working at the Desert Biology Station. A laboratory is also available.

Many individuals and classes from outside schools undertake field trips at the garden to cover work in ornithology, mammalogy, herpetology, botany and other varied studies. Girl and Boy Scouts, birders, garden clubs, camera clubs, and many church groups find the garden a pleasant spot for learning more about the plants and animals of the region. The picnic area provides a place for meetings or for relaxation.

(*Concluded on page* 57)

DWARF CONIFERS DERIVED FROM WITCHES'-BROOMS

Alfred J. Fordham

Condensed from ARNOLDIA, the Arnold Arboretum, Harvard University, June 23, 1967

THE English term *witches'-broom* translates directly from the German word *Hexenbesen*. Both parts of the German compound word are found in English as *hex,* meaning to bewitch, and *besom*, a bundle of twigs (usually of birch) bound together to form the age-old do-it-yourself sweeping implement still used by people in rural Europe.

It seems only natural that medieval Europeans would call these peculiar growths witches'-brooms, for they were accustomed to brooms made from bundles of twigs and were inclined to relate anything mysterious and unexplainable to witchcraft.

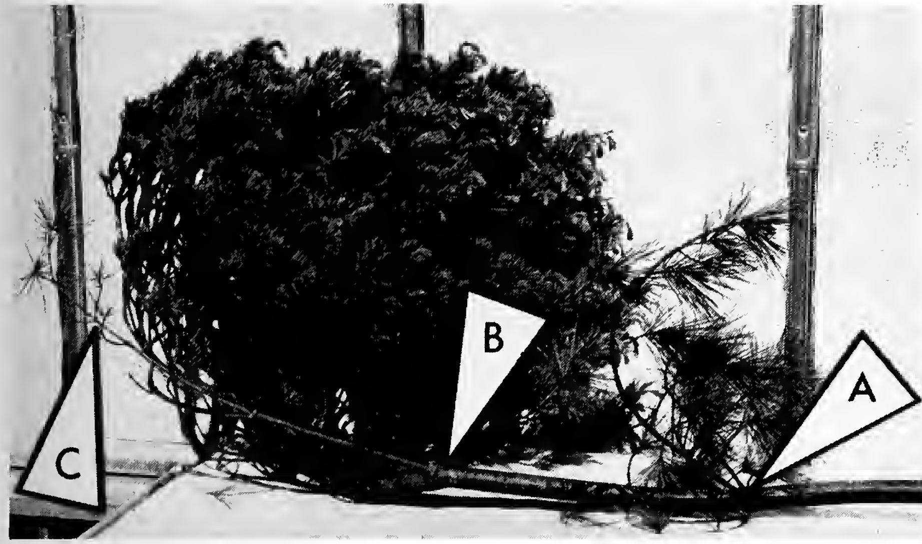
Modern scientific literature abounds with references concerning the investigation of witches'-brooms. They have been found on many species of woody and non-woody plants, and have been shown to result from the stimuli of feeding mites and insects and parasites such as fungi, bacteria, viruses, and one of the higher plants—dwarf mistletoe (*Arceuthobium pusillum*).

Despite the abundance of literature on witches'-brooms in general, few references relate to those that have arisen in the absence of causal organisms, presumably through "bud sports" or mutations. This paper, however, deals with these brooms that appear to be of genetic origin. Such witches'-brooms are relatively common when one has developed an eye for spotting them. During a recent trip to Cape Cod to collect scions of one broom, three other isolated specimens were found. The following Sunday a tour through southeastern Massachusetts led to the discovery of six more. When seeking brooms, a wide and careful search has always been made in the area where one was found, to see if others might be present. In these searches, two brooms have never been found on a single pine tree, and in only one instance has a second been seen within 100 feet of the first. Usually they are many miles apart. This and the fact that they are free of excessive dead parts would tend to support the belief that they are not caused by organisms.

Development from Single Buds

The first illustration shows a witches'-broom collected from a local eastern white pine (*Pinus strobus*). How it came about can best be explained by describing how pine trees of this type grow. With the advent of spring, the cluster of buds located at the tips of the previous year's growth become active and develop into new shoots. During their elongation period such new growths are commonly termed "candles." The time of this activity depends upon location and season—last year in the Boston area it commenced about May 1 and in a scant three weeks the new set of buds had formed.

Returning to the picture, we find a clear-cut illustration of how this particular development is traceable to growth changes that have taken place within the growing point of a single bud. At (A) is a whorl of six normal lateral branches together with a normal leading shoot that terminated its growth and set buds at (B). Leaves on these normal branches measured from 2½ to 3¾ inches in length. The following year a new set of six branches arose at (B), together with a terminal shoot. One of the lateral buds underwent changes that gave rise to the broom. The other five lateral branches were positioned beneath the broom where



Witches'-broom of white pine. This multi-branched mass of foliage came from a single bud (at position B), that underwent physiological changes when it started to grow. (The five remaining lateral buds at that point were so shaded that they failed to survive.) Note the closeness of the growth, then the length of normal internodes, A to B and B to C.

through the years they were too deeply shaded to survive, and their scars are just discernible at (B). The terminal shoot (C), normal in character, had enough light to continue as a spindling growth. It has developed to about pencil thickness while in the same period the broom has become a dense, multibranched, globose mass, 26 inches wide and 23 inches tall, with a basal stem 1 7/8 inches thick. Its leaves, borne on short, thicker-than-normal shoots, measure 7/8 to 1 inch in length.

The broom on red pine (*Pinus resinosa*) shown in the next illustration is the lone survivor in a branch whorl that came into being many years ago. Its leaves are darker in color than those of normal branches on the tree on which it is borne, and it presents an appearance of thrift. Although all other members of the whorl have perished, the broom has managed to survive and prosper.

A similar broom on a pitch pine (*Pinus rigida*) can be observed about 44 feet above ground in the remains of a whorl of branches. Although its host and other trees in the area reflect the impoverished, sandy Cape Cod soil in which they grow, the broom is darker green in color and appears healthy and vigorous. It has been under observation for six years and during the past growing season produced a few pistillate conelets for the first time.

A professional plant collector discovered the original broom and the abnormal seedlings in October 1962. Some seedlings bore leaves about normal in size while others had leaves less than one inch long. The discovery of these abnormal pines illustrates one method by which dwarf conifers may originate spontaneously under natural conditions.

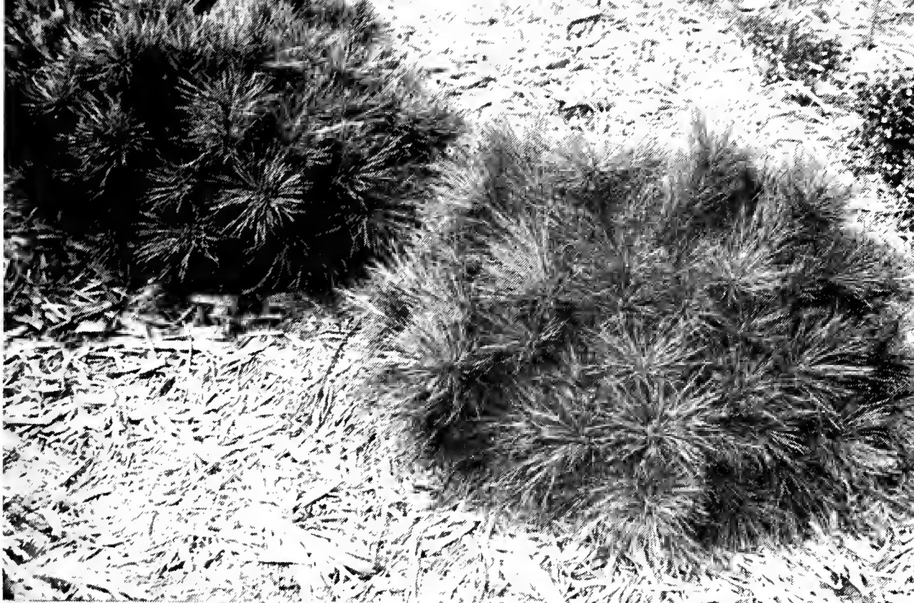
Horticultural Significance of Progeny

Increasing interest in dwarf and slow-growing conifers has given added significance to dwarf plants of witches'-broom origin. Those propagated vegetatively have retained characteristics of the brooms from which they originated, thereby leading to slow-growing forms with year-round interest. They are suit-

Broom on red pine is the lone survivor in a branch whorl that came into being years ago. This illustrates the dominance of a witches'-broom over adjacent growth.

White pine cones from a witches'-broom (*right*), in contrast to normal cones.

able for use in dwarf conifer collections, rock gardens, foundation designs, and situations where plants requiring little or no maintenance are desired. Seedlings from fruiting witches'-brooms have produced large numbers of dwarf and abnormal plants, including forms of prostrate habit suitable for planting over rocks and



Dwarf conifers of witches'-broom origin, propagated by grafting. *Top:* Two specimens of white pine. *Bottom:* A distinctive Canada hemlock.

walls. Still other seedlings characterized by central stems, horizontal leaders, and short internodes quickly develop into miniature plants presenting an appearance of age, making them ideal subjects for bonsai.

As time passes, this increased interest in propagating plants from witches'-brooms will doubtless add greatly to the list of dwarf and unusual plants presently available for horticultural use.

If perchance a reader has knowledge of a fruiting witches'-broom of any conifer, a contribution of its seeds would be welcomed by the Arnold Arboretum to further this study. ♦

THE ROLE OF PLANTS IN MODERN MEDICATION

Adapted from the Symposium on the "Phytopharmacology of Botanic Drugs in Modern Medicine" organized by Dr. Cheney for the Torrey Botanical Club Centennial Year Meeting held at the Brooklyn Center Campus, Long Island University, in October 1967.

Ralph Holt Cheney

FROM earliest times, several hundred plants have been recognized as possessing principles of therapeutic value. Folklore, by trial and error, and the doctrine of signatures, which dictated that a resemblance between a disease and some object, such as the form or color of a plant, indicated curative powers, led to the use of many of these plants. Naturally, some had little or no value, but such origins did guide the way to the discovery of a few of the most helpful drugs now known to man. These have been so much taken for granted that when World War II put a stop to the importation of the crude botanic supply source of such essentials as morphine and quinine, society was shocked into the realization that the physician was still dependent upon plant life for a surprising number of critically needed drugs.

This realization has resulted in more intensive research during the past quarter of a century in the potentialities of plant sources of drugs than occurred throughout the entire preceding century. The discoveries of most of the antibiotics have been made since 1940. Their use and effectiveness in medicine constitute the most spectacular contribution ever made to the control of acute bacterial and virus infections.

For many years the world-wide use of certain invaluable drugs has given pharmaceutical prominence to the plants from which they are derived. Among those worth noting are the cocaine derivatives, curarine, digitalin, ephedrine, atropine, ergotoxin (ergot of rye), morphine, quinine and strychnine.

Cocaine derivatives have daily value for local anaesthesia in dentistry as well as in medicine. Forms of *curare,* such as curarine or the popular Intocostrin type, have significant application in preoperative procedures; in fact, the proper sequential procedures result in satisfactory anaesthetization with less ether, which is very desirable for the welfare and comfort of the patient.

The primary action of *digitalis glucosides* is a stimulating effect on the individual heart fiber. Each fiber also receives more time or rest during diastole—the rhythmical expansion of the cavities of the heart—and each little fiber does more work with less oxygen. Ephedrine reduces certain conditions of surface inflammation of the eye and relieves some types of blood-vessel congestion.

The pharmacologist discovers that many drugs used in human medication act in an antithetical fashion in several senses. *Atropine* and *ergotoxine* are good examples of this situation. Both affect peripheral smooth muscle, but whereas atropine relaxes it, ergotoxine causes tonic contraction of smooth muscle. They oppose each other in several other ways as well. In addition, the uterine stimulatory effects of ergot alkaloids are well known, and their use in postpartum administration has been practiced for many years.

Morphine in the form of morphine sulfate is the most common basal anaesthetic. *Quinine* and its derivatives have various medical uses in addition to their value, as quinine salts, for malaria. Traces of *strychnine* utilization for reasons of stimulation of the central nervous system and in several types of fatigue and neuromuscular disorders have long been recorded in medical literature.

Since 1949 the knowledge of phytochemistry has enabled the pharmaceutical chemist to prepare the wonder drug *cortisone* and its effective derivatives from yams by 17 fewer chemical steps than are required when using animal sources as the natural material. Phytochemistry has also pointed up the ammonium sulfate principle as the key to American Indian use of an extract from the pitcher-plant (*Sarracenia purpurea* L.) for pain. It is now employed in modern anaesthesiology as a nerve block by injection to desensitize sensory nerve fibers, thereby preventing pain while simultaneously not desensitizing motor fibers and hence allowing normal functional movement.

Several new drugs reduce hypertensive conditions. These include (1953) *protoveratrine A & B* from false-hellebore (*Veratrum album* L.) and *andromedotoxin* from leaves of rosebay (*Rhododendron maximum* L.). Also in 1953 the centuries-old extract from the drug rauwolfia (*Rauwolfia serpentina* (L.) Benth. ex Kurz) gave us *reserpine* (Serpasil), introduced so advantageously in modern medicine in the treatment of certain nervous abnormalities.

Currently, the extensive use of safflower oil in dietary application to lower the cholesterol level in the blood is a striking example of the necessity of recognizing the relationship between plant classification (taxonomy) and plant chemistry (phytochemistry). The true, medically significant safflower oil is 80 per cent a complex of linoleic acids which are unsaturated fatty acids obtained from bastard-saffron (*Carthamus tinctoria* L.), which is a member of the Compositae. It is called saffron because the dried florets of the composite head resemble true saffron (*Crocus sativus* L.), a member of the Iridaceae, and they contain a yellow pigment that is used to adulterate true saffron. True saffron and also the meadow-saffron (*Colchicum autumnale* L.) of the Liliaceae are *not* sources of the desirable unsaturated fatty acids, polyunsaturates, which are useful in relation to the blood cholesterol level. Incidentally, the true saffron spice (*Crocus sativus*) is one of the richest known sources of riboflavin (vitamin B2), possessing about three times the amount of riboflavin found in yeast or liver. It is obtained from the stigmas of the flowers, which are gathered laboriously by hand and are therefore expensive.

Hallucinogenic drugs are products of biosynthesis from a variety of plant species. These "mind-trip" or psychotomimetic drugs are medically significant because of their disturbance of the normal functional behavior of the brain, rather than for therapeutic treatment of nervous abnormalities. Three of the best known are *marihuana* or *hashish* from hemp (*Cannabis sativa* L.); *mescaline* from the cactus *Lophophora williamsii* Coulter; and LSD (*d-lysergic acid diethylamide*) from several species, one being one of the morning-glories (*Ipomoea violacea* L.). Due to the current use of these psychedelic (mind-magnifying) drugs by some adolescent groups and adults, recent journalistic reports have been spectacular. Actually, there are many plants that have been employed for centuries in primitive cultures to produce hallucinations. Marihuana has been a social problem since at least 2730 B.C. The active euphoric principles in marihuana constitute a chemical complex known as *tetrahydrocannabinols*.

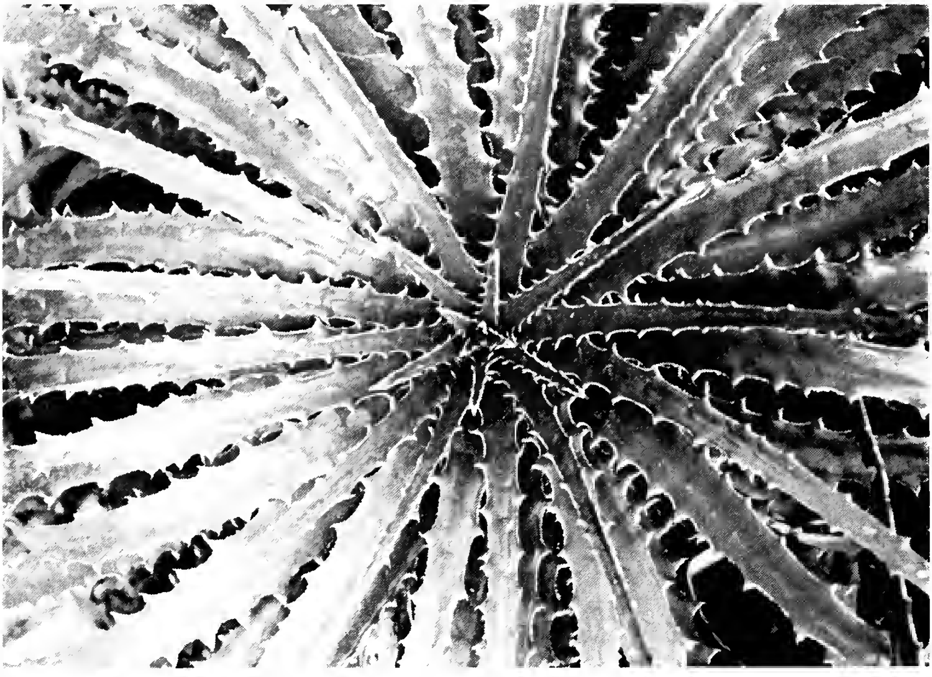
One of the most promising, very recent additions to medication for malignant dysfunction is the discovery of six alkaloids obtained from the blue-flowered, trailing, evergreen herb known as periwinkle or running-myrtle (*Vinca minor* L.) and the erect pink-flowered plant called the Madagascar periwinkle (*Catharanthus roseus* G. Don or *Vinca rosea* L.). These plants belong to the Apocynaceae, or dogbane family, which also provides *Rauwolfia*, mentioned above. They have been demonstrated by intravenous injection to be effective tumor-destroying agents. Two of these alkaloids, *vincaleukoblastine* (VLB) and *leurocristine* (LC), are commercially available to the physician for two types of cancer—leukemia (a

(*Concluded on page* 63)

Heart of an amaryllis, the stamens loaded with pollen

PLANT PATTERNS IN PICTURES

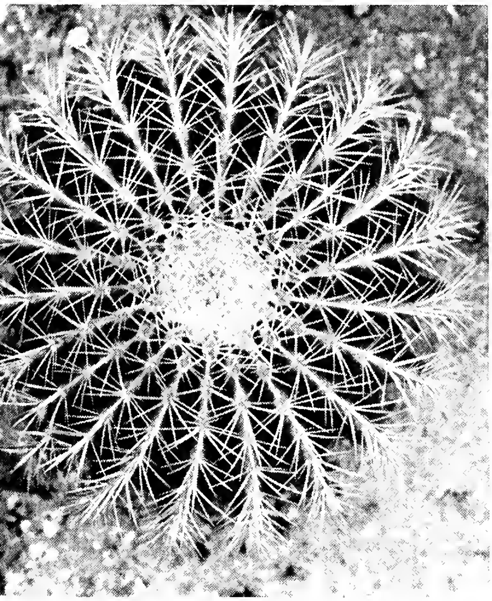
UNDER the title "Patterns of Nature Seen Through a Photographer's Lens," the pictures on these two pages appeared in *Newsday's Garden Almanac*, a special supplement distributed with the paper March 28, 1967, in Garden City, Long Island, New York, and its environs. All were made in the conservatories at the Brooklyn Botanic Garden by William J. Senft, Jr., *Newsday* photographer.



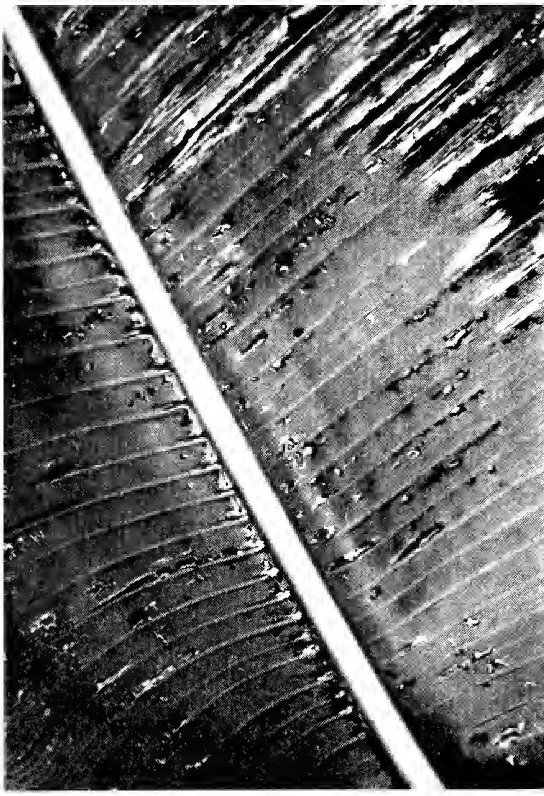
Leaf rosette of *Hechtia argentea*, a spiny bromeliad from Mexico

The "blond" or "woman" fern, a native of Hawaii

Indoor foliage plant from Peru—*Fittonia argyroneura*



The golden ball cactus, *Echinocactus grusonii*



Leaf of a traveler's-palm, *Ravenala madagascariensis*

Research Branch, Canada Department of Agriculture

Arctic lupine grown from seed dating back to the Pleistocene, 10,000 years ago. The plants are identical with the Arctic lupine of today.

10,000-YEAR-OLD SEEDS SPROUT IN CANADA

Lupines made to grow after long period of frozen dormancy

Robert Reinhold

CANADIAN botanists have grown normal healthy plants from seeds believed to have lain dormant for at least 10,000 years in Canada's frozen Arctic wastes.

These specimens are thought to be the oldest living organisms on earth, three times as old as the giant sequoias in California, said Dr. A. E. Porsild, a botanist at the National Museum of Canada, who directed the plant-growing experiment.

The bristlecone pines of the California mountains are said to be even older than the sequoias, but only half as old as the seeds.

Previously, the oldest seeds to have sprouted plants were three dormant sacred lotus seeds found buried in a neolithic canoe in a peat bog near Tokyo in 1951. These seeds were 2,000 years old.

The plants that were grown from the Canadian seeds are Arctic lupines, commonly found today throughout Alaska and Arctic Canada. They are similar to the Russell lupine, a garden plant sometimes grown in moderate climates for its spikes of colorful flowers.

The seeds, about the size of rice kernels, were unearthed in 1954 at Miller Creek, in Canada's Yukon Territory, by a mining engineer who did not realize their scientific significance until a paleontologist from the National Museum of Canada learned of them 12 years later.

The engineer, Harold Schmidt, found two dozen lupine seeds carefully concealed in rodent burrows permanently frozen in silt from 10 to 20 feet below the surface.

Mr. Schmidt kept the seeds, along with a rodent skull from one of the burrows, in a dry place over the years. This prevented the seeds from germinating naturally until the palaeontologist, Dr. D. R. Harington, obtained them and brought them to the museum in Ottawa for study.

There, Dr. Porsild placed the best of the lot on wet filter paper in a laboratory dish. Six germinated within 48 hours. Later they were transferred to pots and placed in a greenhouse, where they have since grown into vigorous young plants indistinguishable from ordinary Arctic lupines.

Now one year old, the plants are on display at the museum. The scientific findings concerning them are published in the October issue of *Science,* weekly journal of the American Association for the Advancement of Science.

Dr. Porsild believes that the seeds were probably preserved after a landslide or a deep layer of volcanic ash covered the burrows, smothering the rodents and keeping the surrounding soil dry and permanently frozen.

"There is no reason to believe there aren't seeds in even older deposits in the North," Dr. Porsild said. "They could date back one million years to the beginning of the Ice Age."

The age of the seeds was established from the rodent skull and the nature of the burrows. The deeply stained, fragile skull was identified as that of a collared lemming, an animal that disappeared from the Miller Creek area about 10,000 years ago, during the Pleistocene era.

Animals bones found in similar burrows in this area have been dated back to at least 14,000 years by radioactive analysis.

The question of seed longevity is one that scholars treat with great caution. Earlier in this century, seeds found in ancient Egyptian pyramids were germinated. Those plants, called "mummy wheat," have since been established as coming from seeds either carried in by modern rodents or sold fraudulently as ancient seed.

It is believed by some botanists that seeds are more likely to be preserved for long periods if under frozen conditions, as in the case of the Canadian seeds.

In his report, Dr. Porsild, who worked in collaboration with the Canadian Department of Agriculture, said:

"It would seem reasonable to predict that seed stored dry and at temperatures well below freezing could remain viable indefinitely." ◆

HARDINESS ZONES

A NEW map in color, showing the numbered zones by which the hardiness of woody plants can be indicated in the United States and Canada, has been issued by the Arnold Arboretum. It is based on the map that originally appeared in 1940 in Alfred Rehder's "Manual of Cultivated Trees and Shrubs," and that has been revised several times since then. The latest revision, undertaken by Donald Wyman of the Arnold Arboretum staff, takes account of recent weather data. It covers all of continental United States (except Alaska) and most of Canada. Copies are available at 10 cents each from the Arnold Arboretum, Jamaica Plain, Mass. 02130. ◆

See next two pages for a black and white copy of the map.

HARDINES[S] Z

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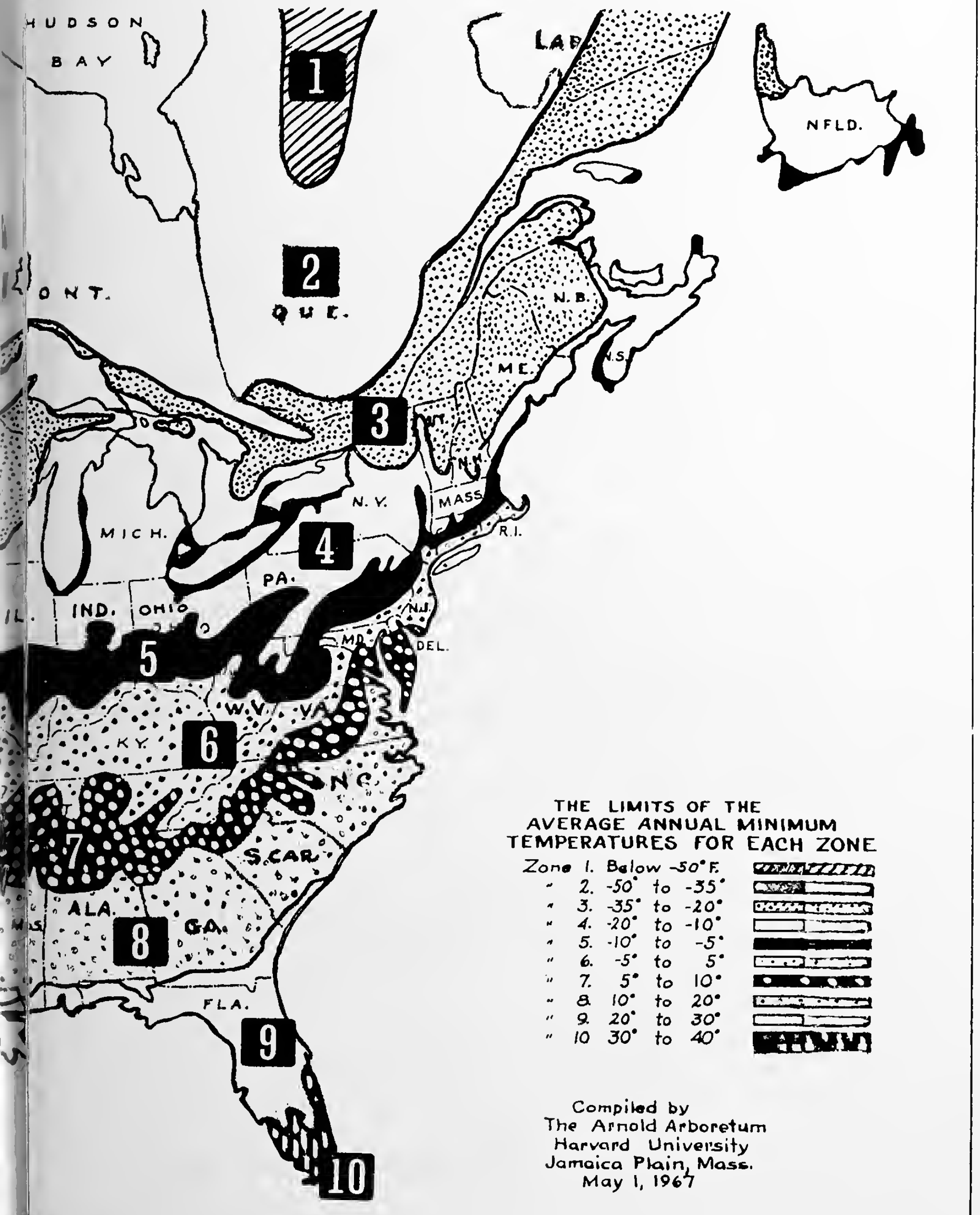


A THERAPEUTIC ARBORETUM

Patients take part in every phase of establishing a new planting at Menninger Foundation in Kansas

Rhea R. McCandliss

Reprinted from the Arboretum and Botanical Garden Bulletin, January 1967

THE Menninger Foundation at Topeka, Kansas, is a center for psychiatry, the training of doctors as psychiatrists, and the treatment of patients with emotional problems. As an avocation, members of the Menninger family have all been better than average amateur horticulturists. Edwin A. Menninger of Florida is the author of several horticultural books. His brothers, their father before them, and now the third generation of doctors have loved plants and studied them in depth. They know how such a knowledge can enrich the lives of men and women, and they have always encouraged their patients and employees, friends and students to learn more about nature.

Dr. C. F. Menninger, the father of Edwin, Dr. Karl and Dr. Will, held regular garden classes for the patients until he was over ninety years of age. He expected them to learn to recognize trees and shrubs by both the common and botanical names. He was an inspirational teacher, and many of the staff, too, learned to know and appreciate nature through his teachings. His large horticultural library will be the nucleus of the library for the new arboretum.

Dr. Karl has long had the dream of an arboretum on the hospital campus. The arboretum will be the result of the combined efforts of the patients, directed by the Adjunctive Therapy staff, and the grounds maintenance men who help us out in an emergency with labor, and advice from the landscape architects employed by the Foundation. There will be patient participation in all phases of the development.

As presently envisioned, the arboretum will not be open to the public except on special occasions. It will be open to the more than 900 employes and to the patients for enjoyment and learning. There is no large arboretum within several hundred miles in any direction. Thus for our immediate climatic area we can develop and provide information on the hardiness and environmental reaction of plants, and demonstrate what will grow here, especially among the newer varieties of trees and shrubs.

We hope, at least at first, to emphasize plant families that will give a long season of color from blossoms in spring, from brilliant fall foliage, and berries both for beauty and to feed the birds. The first planting includes flowering trees and many species and varieties of *Viburnum* which fill our needs in all these ways.

Our Horticultural Therapy program is concerned not only with the development of the arboretum, but also maintains an active program in the greenhouse and gardens, supplying the hospital with plants and cut flowers and making the grounds attractive to those not in this activity. Thirty-five or more patients are assigned for periods of one or two hours a day, five days a week, and a half-day on Saturday.

In order to understand how the development of an arboretum on a hospital campus can be a part of the treatment program to the advantage of both the patients and the resulting arboretum, some understanding of the treatment program is necessary.

At The C. F. Menninger Memorial Hospital the psychiatric treatment centers around milieu therapy. Milieu therapy has been defined by the Drs. Menninger as "the definite therapeutic structuring of the special environment." Here this is the hospital environment, and the important aspect is the *structure* sur-

rounding the patient. Each patient has a daily schedule worked out by the doctor and adjunctive therapist to coincide with his treatment goals. The activities include both work and recreation, balanced to simulate the desirable balance of a normal life situation in our culture.

In the Horticultural Therapy Unit the program is designed also to acquaint the patient with the plant world and his relationship to the environment. Our patients are of all ages and come from all parts of the country, and a few from other countries. The patients who participate daily in the greenhouse and gardening groups are not out of contact with reality; they are intelligent, quite intellectual, well educated, and traveled. They may be scientists, industrialists, professional people, students, or housewives. Many are from urban areas and have never before taken any interest in gardening. Sometimes they are quite sure there is nothing to interest them in this field, a prejudice we gradually overcome by offering a program which includes many aspects of horticulture.

Doctors prescribe for their patients such programs as to provide gratification through the accomplishment of new projects; to overcome isolation of an individual through group social activities; to relieve feelings of guilt by the performance of menial tasks; to develop new skills looking toward a future hobby; to relieve tensions through physically hard tasks or tedious projects for a compulsive patient. These and many more prescriptions can be filled in horticultural therapy activities. Any horticulturist can find the tasks fitting the different prescriptions. The bonus-dividend beyond getting well is that the patient finds a new interest in the world around him, to share with his family in the place to which he will return.

Dr. Karl says we should try to send our patients home "weller than well." In our area we take this to mean with greater satisfaction in his life and environment gained through his new awareness of nature.

Recently a patient said she had visited gardens and studied art in many parts of the world, but it was only after helping with the planning of our arboretum that she realized how a garden originates from a plan made first on paper. Her group had participated in this preliminary planning stage, studying books and catalogs and helping to make lists of desirable plants. When shut in by stormy weather, the group had read aloud and discussed literature from other arboretums.

Some groups have been involved in the propagation of plants from seeds and cuttings, obtained locally or through the seed exchanges. They have studied the basic fundamentals of various types of propagation, and often this has led to further study about hybridization, opening a new field of interest.

Some of our patient groups consist of older women unable to go out in work programs, but they participate by helping to write the labels and by keeping the records as reported to them. Sometimes they make a trip by car to the West Campus to look at what is growing.

In contrast to the lack of help from which some arboretums suffer, we have to find ways to use all the help available. But never do we do something just "to keep the patient busy." Every job or part of the program must have an obvious value in the overall project. For this reason we find time to explain and encourage interested participation in the total program, so each of those involved can feel gratification in accomplishment as the work progresses.

We believe that this interest will carry over to an interest in the community when the patient leaves the hospital. We believe that our hillside arboretum will continue indefinitely as a place where patients can learn the healing values of workiug with plants and communing with nature. ♦

THREE WAYS TO HOLD A HILL

R. E. Atkinson

Reprinted from Flower and Garden, August, 1967

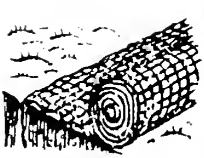
If you live adjacent to a fill slope that threatens to wash down with the next heavy rain, here are three solutions.

1—A Net of Jute

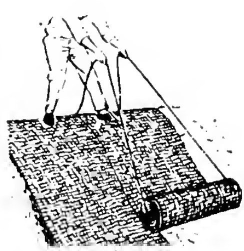
Easiest and lowest in cost is a commercially available net of jute that holds seed and soil until the plants are established. It gives immediate protection as soon as the 225-foot rolls are laid, but they must be applied carefully. The roll is anchored at the top of the hill in a 6-inch-deep slot and let down hill vertically with ropes. Do not stretch the roll; allow it to fall loosely into place. The net should be fastened to soil with 6-inch, 11-gauge wire staples. The rolls must overlap at least 4 inches at sides so that seams will not separate. For short slopes, the rolls may be applied horizontally.

2—Concrete Planters

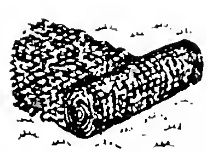
Newest device to appear on the market for holding steep fills is a concrete interlocking planter known as Hold-a-Hill (trademark registered). These are V-shaped blocks that can be laid up rapidly to serve as retaining walls. Units are 36 inches across from tip to tip, 12 inches high, with walls 2 inches thick. No reinforcing bars are used but end anchors are available. An angled recess in the bottom of the nose of each unit locks to the abutting wing ends to form a rigid, continuous wall. Each unit weighs 80 pounds. No mortar or footings are needed for successful installation. They can be



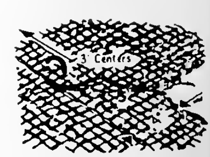
Anchor slot — bury up-channel end of jute net in trench 6" deep. Fasten with wire staples 12 inches apart.



Lower rolls down steep slopes with axle and rope.

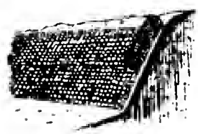


Do not stretch—let jute net lie loosely on surface without tension.

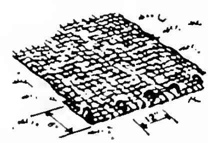


Overlap edges of material at least 4"; insert wire staples on 3 to 4-foot centers.

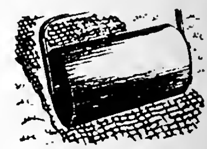
Joining rolls—Make a slot 6" deep; insert up-channel end of new roll; overlap down-channel end of installed roll over the trench 12". Staple 12 inches apart.



On short slopes, jute net can be installed parallel to the contour.

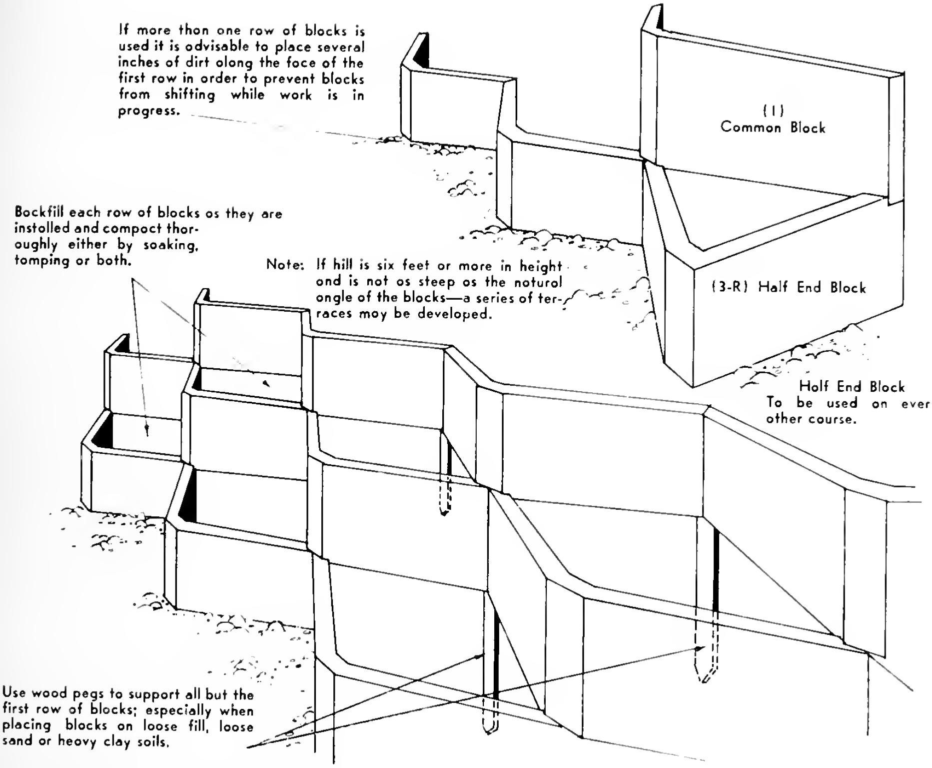


Terminal fold — bring net down to level area, turn end under 6 inches, staple.



Roll installed soil net to be sure it is in even contact with the seeded surface.

How to lay a net of jute on a slope to keep soil from washing away



Details in the installation of Hold-a-Hill blocks*

planted with trees or shrubs but trailing or spreading ground covers are most attractive.

3—A Dry Wall

The secret of Hold-a-Hill and the secret of a dry wall are the same. Leave space for water to drain through and you don't need an engineer to build your wall. A retaining wall must be built like a dam to hold a mountain of water, and an engineer is needed for such a project. But no mortar is used between or on stones in a dry wall and water drains freely away.

To build a dry wall properly you need a deep ditch at the base, 2 feet deep and 30 inches wide. Fill this with a foundation grade concrete mix to a depth of 12 to 15 inches. If the wall is long it must be jointed every 20 feet or so.

Do not trowel the surface for it will be covered with soil. While the concrete cures, work the soil that will be used between the stones. Stockpile the mixture to fill in as the wall rises. A good soil mix is gritty, containing 10 per cent humus with rock chips. It should be free from clay. Hoof-and-horn meal incorporated into the mixture means that no further fertilizing will be needed for several months.

Stones need one face that is fairly smooth and should be roughly flat with more or less parallel sides. They should be at least 4 inches wide. Largest stones should be used at the base.

Cover the concrete base with a layer of soil that slopes back toward the wall. The first stones are tilted and the wall recedes from the vertical about one inch to a

*Under this registered trade name these patented blocks are available from the Hold-a-Hill Planter Block Company, 1567 East 3900 South, Salt Lake City, Utah 84117.

An indoor demonstration of planting with Hold-a-Hill blocks

vertical foot. Cover each stone with at least an inch of soil mix, then add the next rock.

Plants that thrive in the rock garden, especially those that are better viewed close up, are ideal for the dry wall. They should be planted as the wall is built. Otherwise, later, a crowbar must be used for prying apart the rocks so that a plant may be poked into the space. ♦

Genereux

Where plenty of rocks are available, a dry wall is often the most satisfactory way of checking the earth on a short, steep slope; it can also be ornamental.

A FOURTH WAY TO HOLD A HILL

Buhle

Above: This side hill in the Botanic Garden was subject to heavy sheet erosion which resulted in exposure of the large tree roots. Logs 6 to 8 inches in diameter were laid end to end along the bank, partially entrenched, and pegged into place in rows 6 to 8 feet apart, the distance depending on the steepness of the slope. English ivy plants were set out at random, 8 to 10 inches apart. *Below:* The second year after planting—a fine-looking and effective hill-holding groundcover.

Buhle

THE SIMPLICITY OF LATIN NAMES OF PLANTS

Harold William Rickett

Reprinted from The Garden Journal, The New York Botanical Garden, March/April 1967

RECENTLY I wrote a piece[1] about the botanical or Latin names of plants. I pointed out the simplicity of botanical nomenclature, and showed that many who are afraid of it are actually using it for the names of genera.[2]

Genera (plural of genus) are the "kinds" of plants in a broad sense: all the roses are a genus, all the lilies another; each is named by a single word, as *Rosa, Lilium.* Many of these names are in common use by gardeners and nurserymen; they need no further exposition here.

Within a genus we find species; their names are made of the genus-name (called the generic name) plus a second word: *Rose gallica, Lilium tigrinum, Viola pedata.* Such names may indeed—in the current neglect by the schools of the Latin background of our language—dismay the intellectually timid or slothful. Yet the second word—known as a specific epithet—has meaning, often evident to anyone who will really look at it. Most specific epithets are Latin adjectives, or Latinized Greek adjectives, often descriptive of some characteristics by which one distinguishes the species. Others commemorate some collector or botanist.

A complete dictionary of these words cannot be given here. (Aside from the Latin dictionaries, William T. Stearn of the British Museum has lately given us a volume entitled *Botanical Latin* [Hafner Publishing Company, New York, 1966, $16.75] in which an extensive vocabulary is provided.) But it is possible to list and explain even in this brief compass a number of epithets that occur over and over again, attached to different generic names. To become familiar with these is to take the first large step in the knowledge and appreciation of the international language of botany. It is not difficult.

The Endings of Latin Words

First a note on the endings of Latin words. They change with number and gender—niceties that the English language lost long ago. (We still, however, distinguish the masculine "actor" from the feminine "actress," and the nominative "I" from the accusative "me.") A

[1]Published in the previous issue of this magazine (January-February 1967).

[2]The following examples were given:

COMMON NAMES THAT ARE ALSO PROPER BOTANICAL NAMES

Abelia	Calendula	Gaillardia	Petunia
Acacia	Cattleya	Geranium	Phlox
Acanthus	Chrysanthemum	Gladiolus	Rhododendron
Agave	Clematis	Hydrangea	Salvia
Ageratum	Coleus	Iris	Scabiosa
Aloe	Cosmos	Lobelia	Sedum
Alyssum	Cotoneaster	Magnolia	Spiraea
Amaryllis	Crocus	Mimosa	Syringa
Anemone	Dahlia	Mirabilis	Verbena
Artemisia	Delphinium	Narcissus	Veronica
Aster	Dianthus	Nasturtium	Viola
Aubrieta	Freesia	Nemesia	Weigela
Azalea	Fuchsia	Nicotiana	Yucca
Begonia			Zinnia

Latin adjective changes its gender to fit that of the generic name to which it is attached. Most adjectives that concern us here end in *-us* or *-er* (masculine), *-a* (feminine), *-um* (neuter); or in *-is* for masculine and feminine and *-e* for neuter; a few ending in *-or* or *-ns* do not change endings with gender. So we write *Helianthus annuus* and *Helianthus occidentalis, Viola palmata* and *Viola canadensis, Lilium philadelphicum* and *Lilium canadense.* The form of the generic name usually gives us the gender; even when this is not true *(e.g., Quercus alba),* the reference books supply the example to be followed. In what follows, all adjectives are listed in the masculine.

Epithets Made from Names of Persons

Many epithets are made from the names of persons—the first collector of a species or someone in some way responsible for its classification. The person is transformed into a citizen of ancient Rome by the addition to his name of *-ius* or *-us,* or *-ia* if it is a lady: Torreyus, Nuttallius, even Rickettius. The noun thus made appears generally in the genitive (possessive) case: *Lobelia nuttallii* (Nuttall's lobelia), *Triphora rickettii* (Rickett's triphora) *Eupatorium luciaebrauniae* (Lucy Braun's eupatorium). Or the name may acquire an adjectival ending: *Viola brittoniana* (literally the Brittonian violet, *i.e.,* named for Nathaniel Lord Britton, who was the first Director of The New York Botanical Garden).

Compound-word Epithets

Many specific epithets are compound words which join a descriptive adjective or a numerical prefix to the name of some part of a plant. So we have *brevicaulis,* from *brevi-* (short), and *caulis* (stem): "short-stemmed." *Brevisepalus* means "with short sepals"; *flexicaulis* "with bent stem." Learning the meanings of some of the comparatively few words that make such compounds unlocks the significance of hundreds of botanical epithets. Here they are:

Descriptive Adjectives

albi- and Greek *leuco-,* white.
angusti-, narrow.
brevi-, short.
flexi-, bent or flexuous.
grandi-, large.
lati-, broad.
longi-, long.
macro-, large or long.
multi-, many.
parvi-, small.
pauci-, few.
rotundi-, round.
sessili-, sitting, *i.e.* without a stalk.
tenui-, slender.

Numerical Prefixes

uni- and Greek *mono-,* one.
bi- and Greek *di-,* two.
tri-, three.
quadri- and Greek *tetra-,* four.
quinque- and Greek *penta-,* five
a- (Greek particle), without.

Parts of a Plant

caulis, stem.
carpus (Greek *karpos*), fruit.
flos, (*florus*) and Greek *anthos,* flower(s).
folium and Greek *phyllon,* leaf.
pes, foot, *i.e.* stalk.
petalum, petal.
sepalum, sepal.

With the above tenuous linguistic equipment such epithets as *longifolius, quinquefolius, microcarpus, acaulis, sessiliflorus, pauciflorus, latifolius, longipes, leucanthus* should have no terrors.

Geographical Epithets

A third group of epithets are obviously geographical, referring either to the region where a species is abundant or (more commonly) to the place where it was first discovered. *Lilium philadelphicum* is not confined to Philadelphia, but was first observed near there. *Iris missouriensis,* common in the western United States, was discovered near the headwaters of the Missouri River. *Astragalus arizonicus* is abundant in Arizona.

Many of these words are simply state

or country names that have been given Latin endings; they require no translation: *americanus, arizonicus, arkansanus, californicus, canadensis, carolinianus, (caroliniensis), floridanus, illinoensis, marilandicus, mexicanus, missouriensis, ohioensis (ohiensis), pensylvanicus, philadelphicus, texanus (texensis), virginianus (virginicus, virginiensis).* Similar words, of course, describe states or countries or areas in the Old World: *anglicus, chinensis (sinensis), indicus, sibiricus, suecicus.*

Pensylvanicus is so spelled (in most plant names) partly because Pennsylvania was also often written with the single "n" in early times, partly because in Latinizing such a name as "Penn" it was customary to reduce the double letter to one. A few geographic words may not be at once recognizable: *novae-angliae,* genitive case of *Nova Anglia* (New England); *ludovicianus* (of Louisiana, Ludovic being Ludwig or Louis); the town of York in Roman Britain was Eboracum—New York is therefore *Novum Eboracum* or *Noveboracum,* whence *noveboracensis.*

Besides the above more or less precise terms, several words are more general in their indication: *australis* (southern); *borealis* and *septentrionalis* (northern); *occidentalis* (western); *orientalis* (eastern).

The very common adjectives *canadensis* and *missouriensis* must not be interpreted in their modern sense. Many species labeled *canadensis* occur widely through the United States; when they were named, "Canada" meant almost every place west of the Appalachians. Similarly, *missouriensis* often referred to the vast territory watered by the Missouri River. Even "Louisiana" was often taken to include most of the country west of the Mississippi, as "upper Louisiana."

Words That Describe the Sort of Place Where Plants Grow

aquaticus, aquatilis, in water (*aqua*).
arenicola, on sand (*arena*); *cola* means "inhabitant" and does not change ending with gender or number; compare *saxicola.*
arvensis, in fields (*arva*).
campestris, in plains (*campi*).
maritimus, by the sea (*mare*).
montanus, in mountains (*montes*).
palustris, in swamps (*paludes*).
pratensis, in meadows (*prata*).
riparius, on river banks (*ripae*).
sativus, cultivated.
saxicola, on rocks (*saxa*); compare *arenicola.*
sylvestris, sylvaticus, in woods (*sylvae*); strictly, should be *silvestris, silvaticus,* but medieval Latin was not classical.

Words That Designate Color

albidus, albus, white.
atropurpureus, dark purple, almost black (*ater*).
aureus, golden.
azureus, blue.
bicolor, with two colors.
canescens, whitish or becoming whitish (usually with white hairs).
coccineus, scarlet.
concolor, the same color on both sides (of a leaf).
cyaneus, blue.
discolor, with different colors on both sides (of a leaf).
flavus, flavulus, yellow.
fulvus, tawny.
glaucus, whitish with a bloom.
luteus, yellow.
maculatus, spotted.
niger, black.
pallidus, pale.
purpureus, purple; the classical purple was what we call crimson; botanists still use the word in the classical sense.
roseus, rose.
ruber, red.
sanguineus, blood-red.
viridis, viridescens, green, becoming green.
violaceus, violet.

Words That Describe the Shapes and Margins of Leaves

acuminatus, tapering (with concave sides) to a point.
acutus, sharp-pointed
amplexicaulis, embracing the stem.
angustifolius, with narrow leaves.

The shapes of leaves are sometimes reflected in the specific names of plants. Shown in the top row above, left to right, are leaves of *Scrophularia lanceolata, Viola palmata* and *Senecio obovatus.* (Note that in this obovate leaf the broadest part is above the middle. In an ovate leaf, as in *Phlox ovata,* it is nearer the stem end.) Bottom row, left to right: *Viola sagittata, Eupatorium perfoliatum* and *Oenothera laciniata.*

bifidus, cleft into two.
cordatus, cordifolius, heart-shaped, *i.e.* indented at the base; the heart is upside-down.
ellipticus, elliptic.
incisus, incised; deeply cut into sharp teeth.
integer, integerrimus, entire, *i.e.* the margins without teeth or notches.
laciniatus, deeply cut, jagged.
lanceolatus, narrow, pointed, broadest between middle and base.
latifolius, with broad leaves.
linearis, narrow with parallel sides.
linifolius, with leaves like those of *Linum,* flax.
ob-, upside-down; *e.g. obovatus,* ovate with the broader part outward; but *obtusus,* blunt.
ovalifolius, with oval leaves; sides parallel, ends round.
ovatus, ovate, egg-shaped; broadest between middle and base.
palmatus, divided or lobed with parts extending from a common central part or point.
perfoliatus, the stem growing through (*per*) the leaf or pair of joined leaves (*folia*).
pinnatifidus, pinnately cleft but not divided to the midrib.
pinnatus, divided or cleft or lobed into parts arranged along the sides of a central part or midrib.
renifolius, with kidney-shaped leaves.
reniformis, kidney-shaped, *i.e.* broader than long, with an indentation at the point of attachment.

rotundifolius, with round leaves.
sagittifolius, with arrowhead-shaped leaves.
serratus, saw-toothed, the teeth pointing forward.
sinuatus, with edges curving in and out.
tenuifolius, with narrow leaves.
trifidus, cleft into three.
undulatus, with wavy margins.

Words That Describe the Surfaces of Leaves and Stems

asper, rough.
barbatus, bearded, *i.e.* with a tuft of long hairs.
ciliatus, fringed with hairs
glaber, smooth.
hirsutus, hirsute; with coarse hairs.
hirtellus, with coarse but short hairs.
hispidus, bristly.
horridus, horridulus, prickly.
laevis, smooth.
lanatus, lanuginosus, lanulosus, woolly.
mollis, soft (with soft hairs).
pilosus, with long hairs.
pubescens, downy.
scaber, scaberrimus, rough, very rough.
tomentosus, with short tangled hairs.
villosus, shaggy with long hairs.

Words That Describe General Appearance and Manner of Growth

acaulis, without (visible) stem.
bulbosus, growing from or possessing a bulb or bulbs.
erectus, standing erect.
frondosus, leafy.
fruticosus, shrubby.
gracilis, slender.
humilis, low.
nudicaulis, with nude, *i.e.* leafless, stem.
procumbens, bent down and trailing.
prostratus, lying on the ground.
pumilus, dwarf.
ramosus, branching.
repens, reptans, creeping. (Compare "reptile.")
rigidus, stiff.
scandens, climbing.
strictus, straight, erect.
tenellus, tenuis, slender.
tuberosus, growing from or forming a tuber or tubers.

Words That Denote Various Attributes

alternifolius, having "alternate" leaves, *i.e.* leaves borne singly.
annuus, annual; growing from seed to flower in one season.
aromaticus, aromatic.
autumnalis, flowering in autumn.
biennis, biennial; forming leaves the first season of growth, flowers the second.
capillaris, hairlike; very slender.
cernuus, "nodding" or drooping.
citriodorus, having the odor of citrus.
communis, common.
cristatus, crested.
elongatus, elongated.
filiformis, threadlike.
fimbriatus, fringed, *i.e.* the edges cut into narrow teeth.
gramineus, graminifolius, like a grass (*gramen*), with grasslike leaves.
heterophyllus, with leaves of different forms or colors.
inflatus, inflated; expanded, with space inside.
nutans, "nodding" or drooping.
officinalis, "of the shops," *i.e.* used commercially.
pachypodus, with thick stalks.
perennis, perennial; growing and flowering through successive years.
pulchellus, beautiful.
rugosus, wrinkled.
sempervirens, evergreen.
sessilifolius, -florus, with leaves, flowers, lacking stalks.
setaceus, bristle-like.
spectabilis, handsome, showy.
squarrosus, "rough," *i.e.* having the tips of leaves, bracts, etc., bent out and down.
striatus, marked with lines.
suaveolens, sweet-smelling.
tinctorius, used in dyeing.
vernus, flowering in spring.
vulgaris, common. ♦

Alice Mertens

The largest and oldest plant of Welwitschia now known. Carbon dating has established its age at about 1,000 years. Note the clusters of flowers. This specimen is growing in the desert 65 miles from Walvisbay, South-West Africa.

AN ANCIENT DESERT RELICT

Willem J. Tijmens

Extracted from NATURAL HISTORY, The American Museum of Natural History, April 1967

FEW plant species have attracted as many botanists from around the world as *Welwitschia bainesii.* This gnarled, ragged, extraordinary plant is endemic to the Namib Desert, a desolate, windswept region that stretches along the entire coast of South-West Africa and contains little more than sand dunes and diamonds. The plant not only thrives in such a harsh environment but attains remarkable longevity as well. Although not comparable to California's bristlecone pine (*Pinus aristata*)—one of which has been assigned an estimated age of 4,600 years and is now recognized as the world's oldest living plant—*Welwitschia* is a millennial species. I recently brought several pieces of trunk from the large individual illustrated here to the United States for radiocarbon dating. Its age was established as slightly more than a thousand years. The plant was a mere seedling when William the Conqueror engaged his troops in the Battle of Hastings. Such vintage is particularly striking since the plant is not deciduous; its two leaves, split longitudinally by wind (making it appear that many leaves are present), are part of its original photosynthetic equipment.

Rainfall in the Namib Desert averages a scant two inches per year, but there are occasional stretches of two and three years when no rain falls at all. Under these circumstances *Welwitschia* obtains moisture from a 20- to 60-foot-long taproot and from sea mists wafting in off the Atlantic. These are sometimes heavy, es-

pecially in July, and undoubtedly enable *Welwitschia* seeds to germinate. However, it is flowering, not germination, that makes the plant troublesome to cultivate. The seeds normally germinate within three weeks after having been soaked, but it takes approximately 25 years for a plant to produce its first flower. Hence, to successfully cultivate *Welwitschia* in a garden or greenhouse, a grower must combine cheery optimism with an abiding patience. He should also be young enough.

"This land of Cape of Good Hope in farthest Africa no botanist ever had trod. Oh Lord how many, how rare and how wonderful were the plants that on this single day presented themselves to Hermann's eyes." So wrote Linnaeus on viewing what the Dutch physician and botanist [Paul] Hermann had collected in 1680 in South Africa.

A botany professor from a European university once visited a *Welwitschia* plant in the northwestern corner of the country. Fully cognizant of the enormous amount of time required to cultivate the plant, the professor decided to take a shortcut. He simply uprooted a "young" plant, tucked it under his coat, and proceeded to his hotel. After dining in his room, perhaps somewhat victoriously, the professor placed his new prize on one of the room's two beds and placed himself on the other for a good night's sleep. His rest was short-lived. The authorities showed up in the middle of the night, having been tipped off that botanic larceny was in progress. On gaining entrance, the authorities had to take but a step to the incriminating evidence, which lay carefully potted in the middle of the bed. The plant was confiscated and the professor arrested. After several weeks in and out of courts and jails, and after paying a substantial fine, the professor left the country—embarrassed and, presumably, empty-handed. ♦

Two Welwitschia plants about a year and a half old in the Brooklyn Botanic Garden's greenhouse. The leathery leaves grow only at the base; the tips are dead. The protuberances in the center of each plant are the two brown seedling leaves, or cotyledons. They lost their greenness only a few months after emerging from the seed, but they will persist until decayed or mechanically broken off. The plants were grown from papery seeds like those at right (one-half natural size). Also to be seen in the conservatory is a 19-year-old Welwitschia, with two straplike leaves more than 20 inches long. Originally grown at the Boyce Thompson Institute, Yonkers, New York, it was presented to the Botanic Garden in 1965.

Note to gardeners: Packets of African seeds are distributed free to members of the Botanical Society of South Africa. The society devotes itself to preservation of the native flora, and membership is available at modest cost. On request, NATURAL HISTORY will send further details to its readers. Address American Museum of Natural History, Central Park West at 79th Street, New York, N.Y. 10024.

BATTLE OF THE REDWOODS

National park may be years away

Gladwin Hill

EUREKA, Calif.—The world's tallest tree, a 367-foot redwood growing at a remote bend in Redwood Creek here on the Northern California Coast, could legally be cut down tomorrow and sawed into pieces to panel people's dens and make fencing for their yards.

The tree is the property of one of four lumber companies that own around 200 square miles of forest, containing possibly a million redwoods.

No one is threatening to fell the tallest tree. But its indefinite future in private ownership epitomizes one of the most far-reaching and complex national controversies in generations: the battle for a National Redwoods Park. It is a dispute that has divided citizens, members of Congress, Federal and state officials and even conservation groups.

Now, after decades of argument, a "compromise" plan to create a National Redwoods Park has been hopefully started in Congress. But indications here support evidence that it could be years—if ever—before a settlement is reached.

The controversy is another chapter in the new "environmental revolution," in which the American public, suddenly aware of the rapid dwindling of natural resources, such as clean water and breathable air, is embracing corrective measures that dislocate accepted practices of long standing.

Towering Trees

The coast redwood (*Sequoia sempervirens*), which grows taller than—although not as big or as old as—its cousin, the *Sequoiadendron giganteum* of the inland mountains, is found only on the Northwest coast of the United Sttaes.

Blight- and fire-resistant, and requiring 40 to 80 years to reach maturity, redwoods grow for hundreds or even thousands of years, with trunks up to 20 feet in diameter and heights often over 200 feet.

The hushed grandeur of a towering grove of redwoods, the interplay of light and shadow among the massive, rough-barked trunks and delicate fur-like branches dwarf the majesty and awesomeness of a great cathedral.

But a redwood is also commercially valuable. It will bring several times the price of an ordinary tree. One big trunk may represent $1,000 worth of lumber.

Once, naturalists estimate, there were more than 3,000 square miles of coast redwoods. Today fewer than 500 square miles of virgin redwood forest are left—about 300,000 acres.

As far back as 1918, apprehensive conservationists founded the Save-the-Redwoods League in San Francisco, which has raised $12.5-million. This money has been matched with state funds to buy outstanding redwood forests and groves.

Some 50,000 acres of redwood forests are now preserved in four California state parks—Humboldt, Prairie Creek, Del Norte Coast and Jedediah Smith. These are spaced over 150 miles from Humboldt, 250 miles north of San Francisco, almost to the Oregon border.

But in the remaining, privately owned redwood forests, logging is being conducted at a rate of more than 25 acres a day—10,000 a year—by the current leaders of an industry that has been harvesting the redwood belt since before California became a state 118 years ago.

The four companies principally involved in current discussions are the

Georgia-Pacific Corporation, the Simpson Timber Company, the Arcata Redwood Company and the Miller Redwood Company.

If the lumber companies were dealing simply with the cathedral-like groves of redwoods depicted in conservation literature, public indignation might be quick and decisive. But a visitor finds that the situation is not that simple.

Most of the redwoods are on thickly forested, inaccessible, steep mountainsides, mixed in among Douglas-firs, spruce, hemlock and dense secondary growth.

These trees are smaller, and except for occasional impressive stands, their beauty is obscured in the jungle-like verdure. The logging operations often involve as much fir as redwood.

Economic Mainstay

Lumbering is an economic mainstay of the north coast, and the lumber companies are not apologetic about their activities.

Systematic replanting of cutover redwood areas is dictated by both state laws and companies' own interests, so that there will be timber in future decades.

During the current debate the companies have been observing a voluntary moratorium on cutting of "virgin forest," which, the conservationists note, has taken centuries to produce.

Not even the most ardent conservationists are suggesting that all redwood logging be stopped. The basic issues are how much virgin forest should be preserved for the public and how to preserve the choice groves that are in the midst of commercial holdings.

The four state parks encompass 63,000 acres, and some people have suggested that that should be enough redwoods for anybody. But not all of that is virgin redwood. And conservationists are concerned that some of the best park redwood tracts, near river mouths, are threatened by flooding.

Long-time intermittent debate in Congress over enlarging the redwood preserves culminated several years ago in

Save-the-Redwoods League

Giant sequoias of California's High Sierras, the first one of which was seen by white men in 1852.

two principal concepts. One, pushed by the Save-the-Redwoods League, called for an integrated National Redwoods Park taking in the privately owned Mill Creek watershed outside Jedediah Smith Park, the northernmost of the state preserves.

A much more ambitious plan pushed by the Sierra Club, the most militant of the conservationist organizations, stressed acquisition of the Redwood Creek basin, which includes the Tall Trees area in which grows the 367-foot monarch.

The "compromise" plan, authored by Senator Thomas H. Kuchel, Republican of California, and Senator Henry M. Jackson, Democrat of Washington, and recently approved by the Senate Interior Committee, follows the league's Mill Creek concept but calls also for a southern spur along Redwood Creek to include the Tall Trees.

The plan would create a national park of 61,000 acres extending along the coast for 40 miles from Orick to Crescent City, straddling U.S. 101 and reaching from redwood-dotted uplands to the ocean.

Save-the-Redwoods League

Cut-over lanes in the redwood belt, south of Prairie Creek Redwoods State Park and north of Orick, California. *The basic question is:* If cut-over land is replanted to redwoods, will growth rate be fast enough to create a tree crop that will be economically sound?

For tourists and vacationers, the immediate change would not be great. It would mean traveling along U.S. 101 through an integrated preserve that is now in three tracts. The basic change would be in future preservation and development as public attractions of large areas of redwoods that are now inaccessible, and expansion of park facilities.

Plan Takes in State Parks

Of the 61,000 acres, 27,000 would be portions of the northernmost state parks, Prairie Creek, Del Norte Coast and Jedediah Smith.

About an equal amount of linking and supplementary land would be bought or traded from the lumber companies. A total of 5,300 acres would come from other private owners and 635 acres from Federal land.

At the northern end the park would take in 5,700 acres from the Miller company and 845 acres from the Simpson company. The southern portion would

include 12,503 acres from the Arcata company, 5,571 from the Simpson company and 3,055 acres from Georgia-Pacific.

The cost of the plan has been estimated at from $60-million to $100-million, but there are many problems to be worked out apart from money.

Gov. Ronald Reagan has insisted that the state be recompensed for its contribution with segments of coastal land now under Federal military control between San Francisco and San Diego.

The Governor is also insisting that the lumber companies be compensated in comparable timberlands. In the case of Georgia-Pacific, it would lose only about 3 per cent of its 100,000 acres. But the Miller company would be parting with nearly one-third of its 20,000-acre holding.

The United States Forest Service has 14,000 acres of choice redwood land that some Federal officials have suggested for exchange. But Secretary of Agriculture Orville L. Freeman and some members of Congress have strongly opposed this as a matter of principle.

A group of eight national conservation organizations has said it had heard that President Johnson was opposed to a trade of Federal land for private timberland. But a high Administration official said the President had made no decision on the matter. The eight organizations plan a campaign against a trade.

Lumber Companies Protest

The redwood companies, through a trade association, attacked the plan as too disruptive of their business.

Darrell Schroeder, the tall, soft-spoken general manger of the Miller company operation near Crescent City, commented to a visitor that the threatened disruption "has been an awful nightmare to us."

Gesturing from his desk in a small one-story office center toward an impressive array of milling and processing buildings, Mr. Schroeder said:

"We have six or seven million dollars invested here in plant and facilities. We're not quite one-third of the way through our whole development program. We've been just about to start on additional facilities for wood products amounting to a further $14-million investment. The costs of moving the operation, if we didn't get exchange land nearby, would just be pathetic."

The uniformed guard at the Miller company gate was much less restrained in expressing the widespread resentment of north coast residents at what they consider a threat to their livelihood.

"Do you believe in freedom?" he asked vehemently. "If you do, you're not for the park plan. It's not freedom when they can come in and take a man's business away from him.

"Are you a Christian? If you are, you're not for the park plan. The Bible says Noah sent out the dove, and it came back with a twig in its mouth. God made trees for people to use. There's plenty more around here for people to look at if they want to." ♦

SENATE PASSES COMPROMISE REDWOOD PARK MEASURE

Condensed from OUTDOOR NEWS BULLETIN, *Wildlife Management Institute, Nov. 10, 1967*

AUTHORIZATION of a Redwood National Park on California's north coast moved one legislative step closer to realization in November with the Senate's approval of a compromise park plan developed by its Interior and Insular Affairs Committee. By a strong 77 to 6 vote, the Senate sent the bill to the House, where it was not expected to be considered until 1968.

The Senate plan would create a two-unit redwood park aggregating 66,384 acres. This acreage is misleading, however, because it includes three existing state redwood parks, comprising 28,030 acres already protected from cutting, and 4,730 acres of submerged lands. Another 635 acres are in federal ownership. This is a far cry from the 90,000-acre redwood park conservationists have advocated. ♦

GROWTH CONTROL IN PLANTS

Adventurous gardeners have exciting new chemicals at their command

Daphne J. Osborne

Condensed from the GARDENERS CHRONICLE, London, June 21, 1967

THE kind of growth and development that occurs in plants is controlled by minute concentrations of chemical growth-regulating substances, called hormones, which are produced in the roots or shoots in amounts that are determined, very critically, by the day length, light intensity and temperature of the environment. These hormones are transported around the plant and act as chemical messengers between the cells, controlling, in a way that is still not clearly understood, the types of biochemical reactions that occur. And it is, in fact, the kinds of reactions that take place which determine how the different parts of the plant shall grow. So whether a strawberry plant flowers or produces runners depends on how the similar genetic information that is present in every cell of the plant is used in terms of biochemical reactions. Hormones therefore play a central role in translating the external climatic conditions in which the plant grows to the complex internal machinery of the cell. They are molecular messengers, acting as liaison officers between the plant's environment and its metabolism.

Nine years ago the first hormone of a group called the gibberellins was isolated from a higher plant. We now know that the plant synthesises more gibberellins when the days are long and that the gibberellin content in the plant is then highest. We also know that if gibberellin is supplied to the strawberry plant in short days when it would normally be flowering, the plant will stop flowering and produce runners instead. In other words, by altering its level of gibberellin the plant has been made to carry out long-day biochemistry while it is still growing in short days.

More recently, a group of synthetic chemical substances called growth retarddants, which includes one called CCC for short, has aroused a great deal of interest in the biological world. These substances actually reduce the synthesis of the natural gibberellins of the plant. As might be expected therefore, if CCC is supplied to strawberry plants growing in summer long days, the production of runners can be suppressed and flowering encouraged because the natural gibberellin content is lowered.

CCC is probably one of the most promising new growth regulators to be made available to commercial growers. Not only does it reduce gibberellin activity in the plant, but auxin levels may also be lowered. Both auxins and gibberellins are natural hormones that stimulate plant cells to grow. Auxin content regulates the speed of cell growth while gibberellins determine the final number of cells and their size. It is not surprising, therefore, that plants treated with CCC are shorter and stockier, and because the chlorophyll of the leaf is concentrated into a smaller area, the plants look a darker green.

The gardener can use CCC for obtaining sturdy, compact, dark green ornamental plants by application to the leaves or the soil, but the concentrations must be carefully regulated for each particular kind of plant. This is where the gardener should experiment on only a few plants at a time or on only a few branches of shrubs.

One of the most interesting features of CCC-treated plants is their increased resistance to cold and drought.

It is a general rule that lush, fast-growing plants are very susceptible to

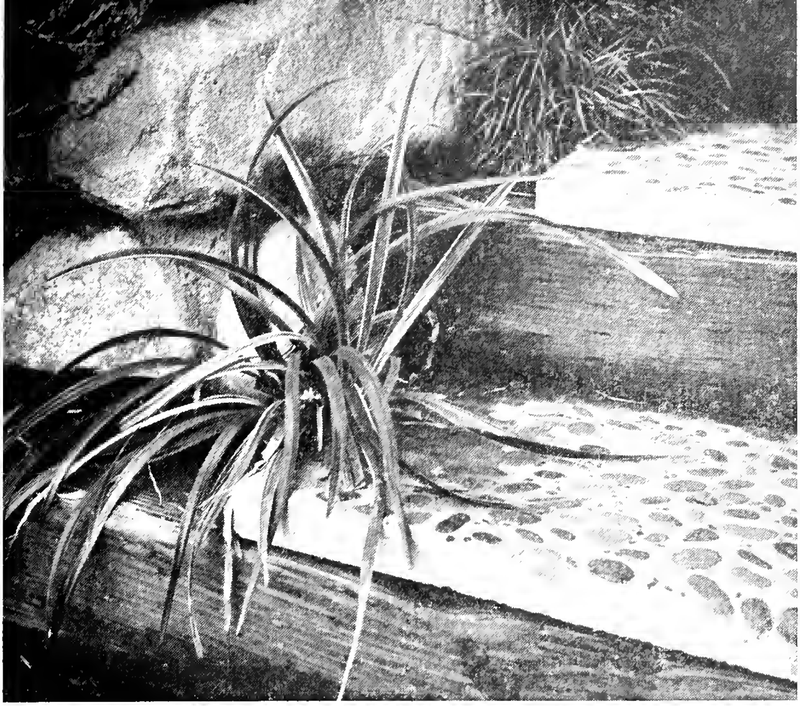
(*Concluded on page* 57)

PEBBLES AND STONES

Condensed from FLOWER AND GARDEN, May 1967

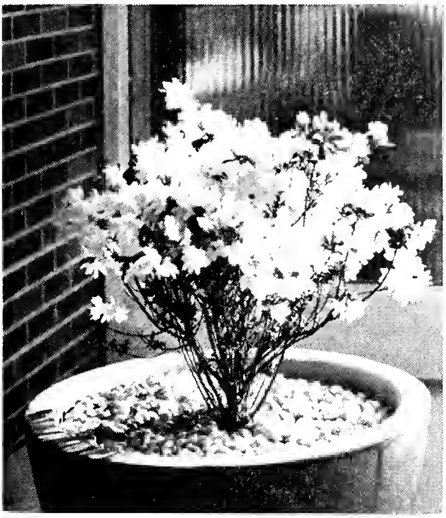
Clyde McClary

Japanese-inspired, this dry stream-bed is a decorative feature in a naturalistic garden. If the dry stream is placed along the foot of a slope and properly graded, it serves to lead off surface water after heavy rains.



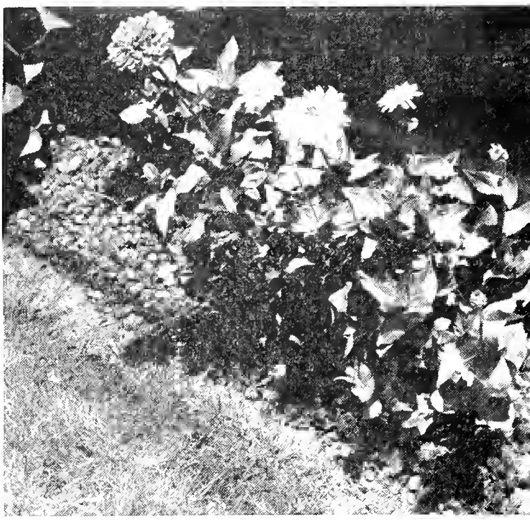
Max Eckert

Stone-embedded concrete slaps laid on railroad ties form the treads of these outdoor steps. Large and small-leaved lily-turfs (*Ophiopogon* or *Mondo*) are planted at one side.



Harry Philpott

The soil in this azalea pot is surfaced with white pebbles, which add to the decorative value of the plant.



Lavona Stillman

A black obsidian gravel ("Apache tears") is used as a mulch on this narrow border of bright zinnias.

WAYS TO TIE YOUR VINES

—*And some handsome vines to tie*

Reprinted from SUNSET magazine, June 1967

THE RIGHT VINE planted in the right place not only enhances the appearance of the garden but can have a marked influence on the garden environment as well.

You can put vines to work making a pleasing pattern against a wall, softening a strong architectural feature, or adding cool greenery to a glaring surface. From a more utilitarian standpoint, you can plant vines for privacy, for wind and sun protection, or to screen an unsightly view. As an added feature, many vines also provide you with a showy display of flowers, some with a delightful fragrance.

In planning a new garden, vines should be considered along with the shrubs and trees; in an established garden you can generally find several places where you can use vines to excellent advantage.

However, you must understand that vines need to be controlled from the start. Otherwise it won't take long before the most vigorous kinds grow out of bounds and become an almost hopeless tangle, developing a thick thatch that shades out leaves and entire branches. Before long, they're taking over much more than their allotted space, diminishing their total effect. Even the more restrained kinds that you select for their pattern value become too dense and heavy unless they're controlled.

Obviously, one essential to good vine management is a sharp pair of shears and the will to use them. Another is an adequate structure for support, and, for most kinds, plenty of ties. (Vines that attach themselves to a surface with adhesive disks or aerial rootlets need very few if any ties.) Make the support strong enough so it won't sag or break under the weight of the full-grown vine. For a heavy one like wisteria or a grape, you may need something as strong and as permanent as a 4 by 4-inch post or a 2-inch-diameter pipe for the uprights if these supports must bear the full weight of the vine. By comparison, firmly fastened galvanized wires, thin wood strips, or ropes are all that light-wooded vines such as deciduous clematis or potato vine require (see the list of vines grouped according to woodiness on page 56).

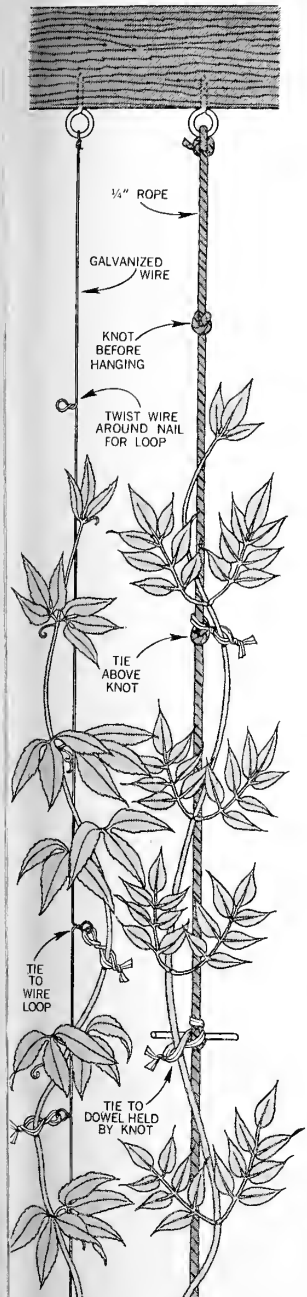
In any case, before you decide which vines you'll grow it's a good idea to look at some well maintained, mature ones. Note especially the type and the size of the structure that they're trained on and exactly how they are fastened to it.

The accompanying drawings illustrate some of the many ways of supporting and tying vines. All the devices shown are available in most hardware or building supply stores.

Vine Ties

You'll find several kinds of vine ties on the market. Use raffia, twine, plastic tape, or paper or plastic-covered wire for tying lightweight vines. Heavier-stemmed vines may need heavy rubber or tubular plastic tree ties, sections of clothesline (woven cotton or plastic covered), strips of canvas or other heavy cloth, lengths of insulated wire, or short sections of garden hose (or similar tubing) encircling a longer piece of strong galvanized wire.

Check ties frequently and loosen or replace them as required. It is often an advantage to use something like lightweight twine or raffia because it weathers and disintegrates in a relatively short time; its short life practically guarantees that it won't cut into the stem as the stem increases in diameter. In most instances you should first wrap the tie around the support in a way that gives you two free ends, then bring one free end across the



other before tying the two ends around the stem of the vine (see drawings).

This figure-8 tie completely encircling the stem gives it a cushion to prevent its rubbing against the fastener or the support. With the ends of the ties accessible on the "outward face" of the vine, it's easy to loosen or retie them as necessary.

Staples and Bolts

It's not a good practice to staple stems directly to a wall; in time the staple may girdle the stem. Even if the staple fits loosely around the stem, winds may cause bruising of the bark from the metal contact. However, a galvanized staple makes an excellent fastener for a vine tie.

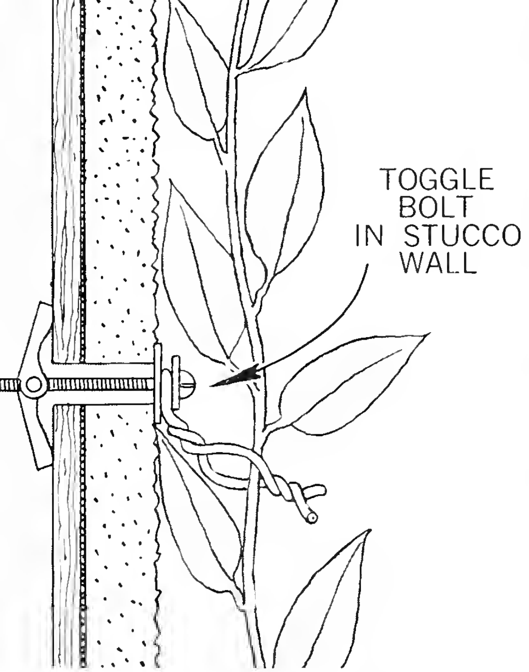
Where summers are hot and vines are planted against sunny walls, it's advisable to take some precautions to prevent sunburning of the leaves and tender young stems. Instead of training a vine to grow on galvanized wire, it's preferable to substitute the insulated kind, which won't absorb nearly as much heat; in some cases nylon rope may be used instead of wire (see various drawings). In these sunny exposures, the vine support (wire, rope, wooden trellis, etc.) should be kept at least 2 inches away from the wall; this permits free air circulation between the wall and the vine and reduces the chances of sunburning. You can reduce the reflection of heat from sunny walls by painting them a dark, heat-absorbing color.

Methods of attaching wires to concrete and wood with bolts and anchoring them in the ground are shown in the drawings on page 56. Toggle bolts (see drawing) and molly bolts are used to fasten vines, or the vine support, to stucco walls.

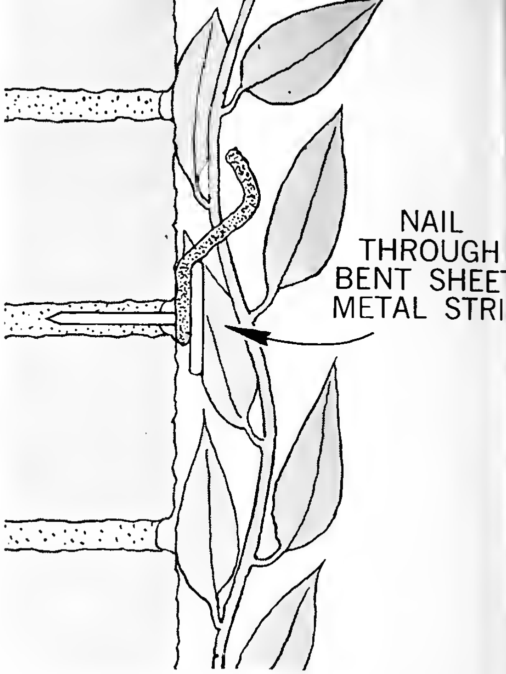
Vines to Consider

For convenience, vines can be divided into three groups, based upon a combination of size and woodiness, as heavy, medium, and light. Here is a brief list of representative vines, and plants often trained as vines (espaliered), in each of these categories.

(*Concluded on next page*)



To hold vine against a stucco wall, make holes with a star or carbide-tipped drill, just large enough to accommodate a toggle bolt (or a molly bolt). Turn bolt until it is locked in place.

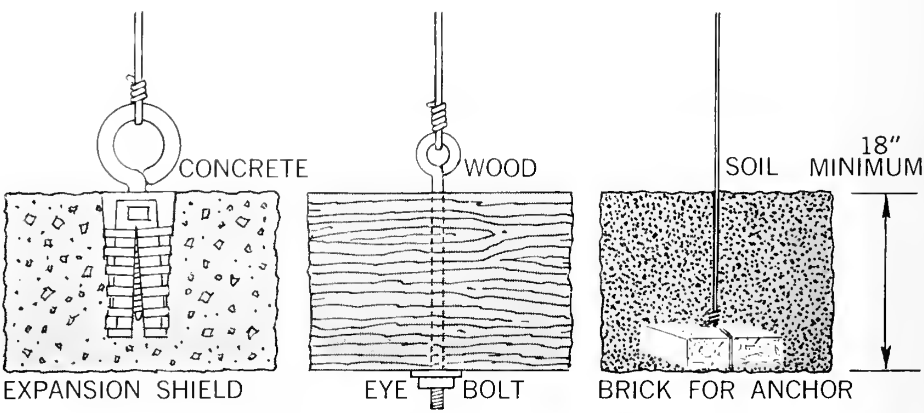


If against a brick wall, drive roofing nails attached to sheetmetal strips or galvanized wire into mortared joints. (Drill if necessary.)

Heavy: bougainvillea, Burmese honeysuckle, Chinese-gooseberry (*Actinidia*), cup-of-gold vine, Easter-lily vine (*Beaumontia grandiflora*), grapes, wisteria. Also such trees as citrus and fig; and such shrubs as star magnolia and xylosma.

Medium: blood-red trumpet vine, Carolina jessamine, evergreen clematis, evergreen grapes (*Cissus*), fatshedera, Guinea-gold vine, and climbing roses. Also such shrubs as Sasanqua camellias, Cape plumbago, fuchsias, pyracanthas.

Light: deciduous clematis, lilac vine (*Hardenbergia comptoniana*), Sprenger asparagus, star jasmine, most annual vines. ◆



Various ways of attaching wires for vine support

BOYCE THOMPSON SOUTHWESTERN ARBORETUM

(*Continued from page* 21)

The Arboretum is open daily from 8 a.m. until 5 p.m. There is no charge for admission, though there is a fee of 25 cents per person for adults for the use of the picnic grounds, where there are tables and grills to accommodate well over a hundred people. Giant sycamores and tamarisk trees shade the picnic area, with desert broom, cholla, and other native plants surrounding the side facing Queen Creek, and salt-bush (*Atriplex* species) screening it from the drive and parking area.

Across Silver King Wash from the picnic area, a eucalyptus grove takes the visitor to the palm grove, the conifer groups, and along the canyon trail where there are pistacia, olive, pomegranate, citrus, and many other exotic trees set among natives such as the saguaro, the mesquites, palo verdes, and cat-claw.

The cactus garden displays many of the barrels, chollas and prickly-pears, as well as the hedgehogs, also more mesquites, palo verdes and acacias. From there one reaches the lake, with its evergreens below the dam, and numerous goldfish following the visitor around the water's edge waiting for scraps of food to be thrown in to them.

Just beyond the lake, towering over the upper edge of the natural area, is Picket Post, the original winter home of Colonel Thompson. A veritable castle, it was originally part of the Arboretum proper, but has been a separate property since 1946.

Following the trail on down into the canyon area and back to the pomegranates, olives, and other introduced trees, one comes to a little house built as if it springs from the side of the hill. Originally a cave house, reputed to have been the home of Apache Indians, the building was added to by Colonel Thompson and made into a little three-room play house for his grandchildren.

Once visited, the Southwestern Arboretum seems to call for another and yet another visit. Its beauty and serenity so beckon that numberless guests return year after year to this tranquil garden in the desert. ◆

GROWTH CONTROL IN PLANTS

(*Continued from page* 51)

extremes of temperature and water shortage, and such plants usually have large cells with thin cell walls. In contrast, plants treated with CCC are slower growing, and have smaller cells with thicker walls and they are correspondingly more resistant to extreme conditions.

Another interesting potential use for growth retardants is the protection that some of them afford against insect attack, for the plant can then become unpalatable or unsuitable to the pest. The cabbage aphid *Brevicoryne brassicae* was found to multiply less rapidly on Brussels sprouts treated with CCC, while another retardant known as Phosfon caused the resident aphids to leave oleander bushes within a week of treatment. One of the many new growth retardants might well prove useful for protecting roses from aphid attack, and would, without question, be preferable to treating them with organic insecticides which kill pests and predators indiscriminately.

Biologists have a great deal of knowledge of how plant growth can be controlled by altering the natural hormone balance, with the result that we have entered the era of the tailor-made plant. The gardener, if he wishes to, can now make use of a whole set of new and exciting chemical tools. With these many kinds of growth-regulating substances he can experiment in a small way on modifying the growth of plants to meet his own special requirements. It may not be very long before we see a rack in the gardener's tool shed containing small bottles of these chemicals, much like the spice rack in a kitchen. ◆

1967 BOOKS WORTH NOTING

In the Library of the Brooklyn Botanic Garden

LANDSCAPING

How to Plan and Plant Your Own Property. Alice Recknagel Ireys. 182 pages, plans and photographs, 4 in color. Morrow, New York. $7.95.

Mrs. Ireys' plans make houses livable—whether a dwelling in contemporary design, colonial mansion, seaside cottage, or a garden room or terrace. (For an extract from her book, see page 7.)

The Wild Gardener in the Wild Landscape. The Art of Naturalistic Landscaping. Warren G. Kenfield. 232 pages, endpapers and 28 photographs (8 in color) by Happy Kitchel Hamilton. Charts and other drawings by Harry E. Van Deusen. Hafner, New York. $7.50.

Twenty-one years' experience in developing a pleasing landscape, largely by controlling the existing plants with herbicides, is fully described. How the selected species can be maintained is also told, and which plants are best to add for naturalizing, from ferns to goldenrods and ironweeds.

GARDENING IN GENERAL

McCall's Garden Book. Gretchen Harshbarger. 520 pages, 8 × 10; photographs and 2-color drawings. Simon & Schuster, New York. $6.95.

Wherever one lives in the United States, sections of this book apply specifically to this area. Topics include landscaping, trees, shrubs, vines and groundcovers, many types of flowering plants, propagation, indoor gardening, and sources for seeds and plants. Cynthia Westcott and Robert Schery have contributed sections on their specialties—disease and pest control and lawns.

The Complete Book of Growing Plants from Seed. Elda Haring. 240 pages, 146 photographs by Walter Haring and others. Diversity Books, Grandview, Missouri. $7.95.

Practical directions for sowing seed in every sort of situation from fluorescent light to open garden, and every kind of plant from annuals to trees.

Gardening in Containers. A Sunset Book. 96 pages, 252 illustrations. Lane Magazine and Book Co., Menlo Park, Calif. New edition. $1.95.

GREENHOUSE AND INDOORS

Foliage Plants for Indoor Gardening. James Underwood Crockett. 165 pages, illustrated in color and black and white. Doubleday, Garden City, New York. $4.95.

Principles behind practices of cultivation clearly explained. Lists and descriptions of plants for various indoor situations. The author was Guest Editor of the Botanic Garden's "Greenhouse Handbook for the Amateur" (1963).

Flowering House Plants Month by Month. Jack Kramer. 128 pages, drawings and color photogaphs. Van Nostrand, Princeton, New Jersey. $5.95.

Greenhouse Gardening for Fun. Claire L. Blake. 256 pages, numerous illustrations. Barrows, New York. $6.95.

Especially good for beginners, telling how to erect a greenhouse, then care for its plants.

SPECIAL PLANTS

The Rothschild Rhododendrons. C. E. Lucas Phillips and Peter N. Barber. 138 pages, 9 × 12. Drawings by Gillian Kenny, 65 color plates by Harry Smith. Foreword by The Lord Aberconway. Dodd, Mead, New York. $40.

Descriptive narrative of the magnificent collection at Exbury and of the breeding that goes on continuously; also the fine details of culture, including the Exbury method of propagating from seed.

Bromeliads in Color and Their Culture. Victoria Padilla. 125 pages, photographs, many in color. The Bromeliad Society, 648 South Saltair Avenue, Los Angeles, California, 90049. $5.95.

Iris: Goddess of the Garden. Winifred Ross. 180 pages, 12 color photographs, many black and white. Diversity Books, Kansas City, Missouri. $5.95.

How to plant, care for, hybridize, show and photograph, with special emphasis on bearded iris.

Begonias—Indoors and Out. Jack Kramer. 128 pages, generously illustrated. Dutton, New York. $3.95.

More than 300 kinds of begonias discussed in this basic garden guide, one of a series.

The Rose in India. B. P. Pal. 265 pages, 80 illustrations, 18 figures. Indian Council of Agricultural Research, New Delhi. $12.

Brief account of the rose in history, literature, myth, legends, art, music, poetry and heraldry; useful information on rose growing and commercial manufacture of rose products.

The Concise Handbook of Roses. Eigil Kiaer. 111 pages, 64 pages of colored illustrations, numerous drawings. Dutton, New York. $5.95.

Colour Compact (a book on succulents). Text in Japanese. 152 pages, 230 color plates, 246 black and white plates. Scientific names given beside pictures of plants. Tokyo Shuppan Haubai Co., Ltd. (dealer). $2.

BONSAI

The Masters' Book of Bonsai. Compiled by the Directors of the Japan Bonsai Association, Nobukichi Koide, Saburō Kato, and Fusazō Takeyama. 144 pages, extensively illustrated with drawings and photographs in black and white and in color. Kodansha International Ltd., Tokyo, Japan, and Palo Alto, California. $5.95.

Complete and precise directions, with summarizing charts at end.

The Art of Shaping Shrubs, Trees, and Other Plants. Tatsuo and Kiyoko Ishimoto. 125 pages, over 200 photographs. Crown, New York, 1966. $3.95.

Not only Japanese methods, but the most approved practices in Italy, Sweden, the United States and numerous other countries.

FRAGRANCES AND FLAVORS

The Fragrant Year. Scented Plants for Your Garden and Your House. Helen Van Pelt Wilson and Léonie Bell. 306 pages 7 × 10. 100 drawings by Léonie Bell. Barrows, New York. $10.

After a classification of scents, the fragrances of winter and spring are discussed, then those of early bulbs and of summer shrubs, trees and vines, and of such special plants as roses, pinks and lilies.

Fragrance and Fragrant Plants for House and Garden. Nelson Coon. 235 pages, photographs. Diversity Books, Grandview, Missouri. $7.95.

Part I deals with the "subtle sense" of smell and with odors of all kinds and their significance and uses; Part II mainly with plants of many kinds that offer odors from their flowers or leaves.

Flower Cookery. Mary MacNicol. 263 pages. Fleet Press Corporation, New York. $10.

Alphabetically arranged account of the use of flowers in cookery of many nations, with recipes.

How to Grow Herbs for Gourmet Cooking. Frederick O. Anderson. 280 pages, drawings and photographs. Meredith Press, New York. $6.95.

Many styles of herb gardens, more than 200 scented plants to grow in them, and 100 tempting recipes from around the world.

Free for the Eating. Bradford Angier, 191 pages, illustrated. Stackpole Books, Harrisburg, Pennsylvania. $4.95.

Three hundred ways to use 100 different wild plants of the United States.

WILD FLOWERS AND TREES

Wild Flowers of the United States. Harold William Rickett. Vol. 2, The Southeastern States, in 2 parts. 688 pages, 9 $\frac{11}{16}$ by 12$\frac{13}{16}$. 241 full-page color plates, illustrating more than 1,000 species; many detail drawings by Rachel Speiser. McGraw-Hill, New York $44.50.

In describing the many hundreds of plants included in this volume, as in the first, technical language has been dispensed with almost entirely. Thus, identification of wild flowers has never been easier or pleasanter to achieve. A well-illustrated glossary precedes the descriptions. Exquisite title-page painting of a passion-flower is by Anne Ophelia Dowden.

The series is sponsored by The New York Botanical Garden. This volume covers the area from the Atlantic to Arkansas and eastern Texas and from the southern borders of Virginia, Kentucky and Missouri to the Gulf of Mexico.

Familiar Trees of America. William Carey Grimm. 240 pages, drawings and maps for 119 species, illustrated glossary. Harper & Row, New York. $5.95.

Recognizing Native Shrubs. William Carey Grimm. 319 pages, many sketches. Stackpole Books, Harrisburg, Pennsylvania. $7.95.

Vines are included. Keys to species are an aid in identifying the woody plants.

Norsk Fargeflora (Norwegian Flowers in Color). Bjorn Ursing. 233 pages, 860 color plates. Text in Norwegian. Ernst G. Mortensens Forlag, Oslo. $2.95.

Scientific names and popular Norwegian names given.

The Wild Flowers of Southern Africa. A Rambler's Pocket Guide: Natal. Winifred G. Wright. 168 pages, 8 color plates, 200 black and white illustrations. Nelson, Johannesburg. $3.50.

The author states where she has seen each flower and when, gives medicinal use (if any), also popular English and native names.

OUTDOOR OBSERVATIONS

Outdoors USA. Jack Hayes, editor. USDA Yearbook of Agriculture, 1967. 408 pages, illustrated in black and white and in color. Foreword by Orville L. Freeman, Secretary of Agriculture. United States Goverument Printing Office, Washington, D. C. 20402. $2.75.

Mountain tops and valleys, farms and recreation, conservation, beautification and devolpment of natural resources.

Canada's Mountain National Parks. Robert Scharff. 184 pages, colored illustrations. David McKay, New York. $4.50.

A small but comprehensive handbook, mentioning trees, birds, flowers and animals of each park and accommodations available.

Wings in the Meadow. Jo Brewer. Wash drawings by Henry B. Kane. Preface by John C. Downey. Houghton Mifflin, Boston. $4.95.

Mainly about butterflies; an intimate yet authoritative book, tying together the whole life structure in an unmown strip of New England countryside.

EMPHASIS ON PICTURES

The World in Colour. Edited by Richard K. Treavor. 205 pages, 8 1/2 by 11 1/2, 4 or 5 color illustrations on each. Nelson Doubleday, Garden City, New York. $12.95.

Nature's Wonders in Full Color. Charles L. Sherman. 252 pages, 462 pictures in color. Hanover House, Garden City, New York. $7.50.

Roses of Yesterday. Dorothy Stemler. Foreword by James Gould Cozzens. Watercolors by Nanae Ito. 55 pages, 18 illustrations in color. Hallmark Cards, Kansas City, Missouri. Distributed by Doubleday, New York. $3.50.

FLOWER ARRANGEMENT

Flowers for Your Church. Adelaide B. Wilson and Lois Wilson; edited by Helen Van Pelt Wilson. 148 pages; 74 photographs, 12 in color. Barrows, New York. $6.95.

The authors have had broad experience in observing and creating living decorations in houses of worship. Their photographs cover many thousands of miles and many situations and styles.

Creativity in Flower Arrangements. Frances Bode. 160 pages, photographs by William Bode. Hearthside, New York. $5.95.

Flowers and Symbols for the Christian Year. New Trends in Decorations for Church, Home, and Flower Show. Ruth E. Mullins. 160 pages, 100 black-and-white photographs, 6 in color, 20 drawings. Hearthside Press, New York. $6.95.

New Ideas for Christmas Decorations with Greens, Pods and Cones. Nora Fields. 160 pages, photographs. Hearthside Press, New York. $4.95.

How to Arrange Flowers for All Occasions. Katherine N. Cutler. 256 pages, drawings and photographs, some in color. Doubleday, New York. $4.95.

Flower Arrangements That Last. Marian Klamkin. 182 pages, photographs and drawings. Macmillan, New York. $5.95.

New Trends in Dried Arrangements. Mabel Squires. 128 pages, 47 photographs by Richard E. Green. Barrows, New York. $3.95.

Driftwood Miniatures. Florence M. Schaffer. 128 pages, photographs. Hearthside Press, New York. $4.95.

A Guide to Flower Arranging in 10 Easy Lessons. Phyllis Shields. 117 pages, 26 photographs. Charles T. Branford Co., Newton Centre, Mass. $4.75.

Flowers at the White House. Ruth Montgomery. 104 pages, lavishly illustrated. Barrows, New York. $8.95.

Flowers and Furniture in America's Historic Homes. Elfreda Fitch. 117 pages, 107 illustrations. Hearthside Press, New York. $10.

A picture book of rooms in historic homes and flowers in the gardens, also flower arrangements.

BOOKS FROM ENGLAND

The Sunday Times Gardening Book. Lanning Roper. 240 pages, 8½ × 11, photographs in black and white and color. Thomas Nelson & Sons, Ltd., London. 63s.

A refreshing point of view on many plants familiar to American gardeners, with stimulating ideas on numerous new kinds to be tried. The author is a transplanted American who is gardening correspondent to the *Sunday Times* of London.

Shrubs in Colour. A. G. L. Hellyer. 128 pages, $8\frac{1}{2} \times 11$, many drawings and color pictures. First published by Collingridge, London, 1965. Doubleday, New York. $8.95.

Shrubs and vines as grown in England.

Flowers for All Occasions. Enid Tangye. 152 pages, photographs. Hawthorn Books, New York. $7.95.

Written and photographed in England, hence gives English ideas of foliage and flowers for any occasion or season.

Begonias, Gloxinias and African Violets. H. G. Witham Fogg. 175 pages, drawings and photographs, some in color. John Gifford Ltd., London. $5.50.

Pelargoniums: A Complete Guide to Their Cultivation. Henry J. Wood. 168 pages, 30 color illustrations. Faber & Faber, London. $7.05.

Mountain Flowers in Color. Anthony Huxley. 428 pages, 112 color plates, 36 black and white plates. Macmillan, New York. $5.95.

More than 1200 alpine flowers, mainly European, presented.

The Natural History of Palms. E. J. H. Corner. 393 pages, 133 figures. Weidenfeld & Nicolson, London. $15.

BACKGROUND READING

Plants of the World. H. C. D. deWit. 335 pages, illustrated with 187 color plates and 233 black and white. Dutton, New York. $17.50.

Flowering plants and their flowers can be spectacular. This is no less true of a delicate sundew than of a rafflesia, probably the world's largest flower. The deWit book makes this evident.

But this is not essentially a picture book. It is a story of plants, chiefly the flowering ones. It explains their relationship to one another, tells how they grow from seed to flower to fruit and seed again. In clearer language than most textbooks use, the structure and form of plants and their evolution are explained, with ample drawings; also how they are classified and named by botanists. The book is an intriguing introduction to botany.

The Language of Gardening. George F. Hull. 191 pages, drawings by Leslie H. O'Rear. World Publishing Company, Cleveland, Ohio. $4.95.

An informal dictionary of horticultural terms.

The Garden, an Illustrated History. Julia S. Berrall. 388 pages, full-page and double-page illustrations, partly in color. Viking, New York. $15.

An Introduction to Trees. John Kieran. 77 pages; 100 color illustrations. Doubleday, Garden City, New York. $4.50.

The Friends of John Gerard (1545-1612) Surgeon and Botanist. Robert H. Jeffers. 99 pages, 12 reproductions from Gerard's "The Herball." The Herb Grower Press, Falls Village, Connecticut. $6.

Through painstaking research, much of it in 16th century books and records, Mr. Jeffers introduces the reader to people and places that were associated with the great herbalist.

MORE OR LESS TECHNICAL

The Grafter's Handbook. Robert John Garner. 263 pages, 32 plates, 117 diagrams. Oxford University Press, New York. $5.75.

Third edition of a standard work, revised, with new techniques described.

Tropical & Subtropical Agriculture, Vol. I and II. J. J. Ochse, M. J. Soule, Jr., M. C. Dijkman and C. Wehlburg. 1446 pages, 285 figures. Macmillan, New York. $35.00.

Introduction to Genetics and Cytogenetics. Herbert Parkes Riley. 596 pages, 154 illustrations. Hafner Publishing Company, New York. $12.50.

A Handbook of Coniferae and Ginkgoaceae. W. Dallimore and A. B. Jackson. Fourth edition, revised by S. G. Harrison, 729 pages, 46 plates, 131 diagrams. St. Martins Press, New York. $35.

The Genus Pinus. N. T. Mirov. 602 pages, 119 illustrations. Ronald Press, New York. $15.

History and fossil history, geography, genetics, morphology, physiology, ecology, chemistry and taxonomy.

The Bamboos: A Fresh Perspective. F. A. McClure. 347 pages, 99 figures. Harvard University Press, Cambridge, Mass. $10.

FOR CHILDREN

Milkweed. Millicent E. Selsam. Photographs (partly in color) by Jerome Wexler. Morrow Junior Books, New York. $3.95.

Plenty of pictures with just a few lines of text in large type on each page.

MISCELLANY

Devotionals on Flowers of the Bible. Grace P. Wellborn. 128 pages, drawings by D. E. Carrell. Baker Book House, Grand Rapids, Michigan. $2.95.

The Poppy and Other Deadly Plants. Esther Baskin. 73 pages, 8½ by 11. Drawings by Leonard Baskin. Delacorte Press, New York. $12.50.

Without botanical names, this book has little practical value. The information, if applied to the wrong plant, could even be dangerous.

Companion Plants and How to Use Them. Helen Philbrick and Richard Gregg. Sponsored by Bio-Dynamic Farming and Gardening Association. 111 pages. Devin-Adair, New York, 1966. $3.75.

Stinging nettle "helps neighboring plants grow more resistant to spoiling." "A few radish seeds sown beside cucumber plants will keep away striped cucumber beetle." "Hyssop planted near grapevines increases the yield of grapes." This is the sort of information provided.

IMPORTANT BOOKS REPRINTED

Anyone Can Grow Roses. Cynthia Westcott. 4th edition (first Collier edition), 220 pages, illustrated. Collier Books, New York. Paperback, $1.95.

A standard guide that greatly simplifies the growing of roses. Dr. Westcott is well known to many easterners who have attended the annual Rose Day that she has held in her garden for more than a quarter century.

Forest Trees of the Pacific Slope. George B. Sudworth. 455 pages, illustrated with drawings. First published 1908. New foreword by Woodbridge Metcalf. New table of changes in nomenclature by E. S. Harrar. Dove, New York. Paperback, $3.

Cacti and Succulents. (A Practical Handbook). Walther Haage, translated and revised by E. E. Kemp. 264 pages, 900 illustrations, both drawings and color photographs. Reprint of 1963 edition. Dutton, New York, $10.

These from Hafner, New York

Pollen Morphology and Plant Taxonomy: Angiosperms. G. Erdtman. 553 pages, 261 illustrations. $14.

Florula Ludoviciana, or *Flora of the State of Louisiana.* C. S. Rafinesque. 178 pages. $12.50.

The Thelephoraceae of North America I—XV. Edward Angus Burt. 770 pages, 47 text illustrations, 27 plates. $22.

Arbustum Americanum: The American Grove. Humphry Marshall. Catalogue Alphabétique des Arbres et Arbrisseaux, translated by M. Lezermes. Introduction by Joseph Ewan. 278 pages. $20.

A Bibliography of American Natural History. The Pioneer Century, 1769-1865. Max Meisel. Vol. I—244 pages; Vol. II—741 pages; Vol. III—749 pages. $50.

Memorials of John Bartram and Humphry Marshall. William Darlington. Introduction by Joseph Ewan. 585 pages. $20.

RECENT GOVERNMENT BULLETINS FOR GARDENERS

NUMEROUS helpful bulletins for gardeners are published by the United States Department of Agriculture. They are available at modest cost from the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402. Among recent titles are:

- Lawn Weed Control with Herbicides (No. 123)—15 cents
- Growing Peonies (No. 126)—10 cents
- Growing Hollies (No. 130)—5 cents
- Growing Dahlias (No. 131)—5 cents
- Growing Flowering Crabapples (No. 135)—20 cents
- Controlling Insects on Flowers (Agriculture Information Bulletin No. 237)—45 cents
- Using Phenoxy Herbicides Effectively (No. 2X)—15 cents
- Roses for the Home (No. 4X)—15 cents
- Landscape Development (No. 33X)—75 cents
- A Guide for Natural Beauty (No. 16-S/S)—55 cents

Purchasers are requested to include the zip code in their address. Postage stamps are not acceptable in making these small payments. ♦

TWO GUIDES FOR DETERMINING COLORS

IN 1941 the Royal Horticultural Society became a pioneer in its production of a chart by which flower colors could be accurately identified. A new edition, developed in quite a different style, has just been issued. The four patches of color of lessening intensity on each of the 200 leaves reach to the edge so that they can now be fanned out and held directly against a flower. The colors are solid instead of being reproduced with a half-tone screen.

Many of the little-known names of colors previously used have been abandoned. Instead, any color can be defined in terms of its hue, brightness and saturation. Cross-references are given to other important color charts.

Copies of the new publication, "The R.H.S. Colour Chart," are available to non-fellows of the society for 5 guineas plus 5 shillings for postage and packing (total $12.60). Address the Secretary, The Royal Horticultural Society, Vincent Square, London, S. W. 1, England.

Meanwhile, in 1957, the "Nickerson Color Fan," the color chart that opens like a fan, was published in the United States. This is a compact guide of 40 separate leaves with seven tones marked off on each. Printed in small type on each color chip is the descriptive color name and its numerical designation in the Munsell System of Color Notation. A booklet accompanies the fan. The chart uses color names that have been selected as standard by the Inter-Society Color Council and by the National Bureau of Standards.

PEST CONTROL INDOORS AND OUT

"A GUIDE to Safe Pest Control Around the Home," issued by Cornell University, emphasizes use of pesticides that do not in themselves create undesirable conditions. Directions are given for the care of cupboards as well as plants. The 40-page booklet can be obtained for 25 cents from the Publications Mailing Room, Building 7, Research Park, Cornell University, Ithaca, N. Y. 14850.

As a further clue to the safe use of pesticides, the New York State College of Agriculture at Cornell has distributed a leaflet which asks each gardener to give attention to these questions:

Have I followed exactly the directions on the label?

Have I provided a safe place for storage?

Do people or animals have access to my place of disposal?

Only the third question should be answered in the negative.

PLANTS IN MEDICATION

(*Continued from page* 27)

blood cancer) and Hodgkin's disease, a fatal malfunctioning of the lymphoid system. Statistics of their effectiveness in inhibiting or destroying certain tumor growths are encouraging.

Thus, pharmacognostical, phytochemical and pharmacological research continues annually to contribute to the improvement of human welfare by providing new medicinal agents derived from plants which are of chemotherapeutic value to man.

INDEX TO VOLUME 23 (1967)

Spring Issue, HANDBOOK ON GESNERIADS, pages 1-81
Summer Issue, HANDBOOK ON ORCHIDS, pages 1-81
Autumn Issue, ORIGINS OF AMERICAN HORTICULTURE, pages 1-89
Winter Issue, THE YEAR'S HIGHLIGHTS IN GARDENING AND HORTICULTURE, pages 1-65

Symbols: Sp (Spring, No. 1); Su (Summer, No. 2); A (Autumn, No. 3); W (Winter, No. 4). **Boldface** page numbers indicate illustrations.

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION
(Act of October 23, 1962; Section 4369, Title 39, United States Code)

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10. Extent and nature of circulation:

A. Total No. copies printed (net press run)	16,000*	16,000†
B. Paid circulation		
1. Sales through dealers carriers, street vendors and counter sales	469*	117†
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C. Total paid circulation	9,385*	8,843†
D Free distribution (including samles) by mail, carrier or other means	304*	319†
E. Total distribution (sum of C and D)	9,689*	9,162†
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G. Total (Sum of E & F—should equal net press run shown in A)	16,000*	16,000†

*Average No. copies each issue during preceding 12 months.
†Single issue nearest to filing date.

I certify that the statements made by me above are correct and complete.
GEORGE S. AVERY, *Director*, Brooklyn Botanic Garden.